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Bulletin 691, Volume 2. April 1985. *Forests and the West Virginia Economy: The Timber Resource.* Gary W. Zinn and Kenneth D. Jones.

Bulletin 691, Volume 3. November 1985. *Forests and the West Virginia Economy: The Commercial Timber Harvest in West Virginia.* Kenneth D. Jones and Gary W. Zinn.

Bulletin 691, Volume 4. April 1986. *Forests and the West Virginia Economy: The Size and Economic Performance of West Virginia's Wood Products Industry.* Kenneth D. Jones and Gary W. Zinn.

Bulletin 691, Volume 5. November 1986. *Forests and the West Virginia Economy: The Economic Importance of Forest-based Industries in West Virginia.* Kenneth D. Jones and Gary W. Zinn.

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Bulletin 691, Volume 7. April 1987. *Forests and the West Virginia Economy: The Business Climate for Forest-based Industries in West Virginia.* Kenneth D. Jones and Gary W. Zinn.

Bulletin 691, Volume 8. August 1987. *Forests and the West Virginia Economy: Summary of Findings, Conclusions and Recommendations.* Gary W. Zinn and Kenneth D. Jones.

FORESTS & THE WEST VIRGINIA ECONOMY

Volume 1: Forest Land Base, Forest History and Types, Forest Ownership and Inventory

Bulletin 691—Volume 1, December 1984
Agricultural and Forestry Experiment Station
West Virginia University
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Authors

Gary W. Zinn is associate forest scientist and Kenneth D. Jones is research technologist in the Division of Forestry, West Virginia Agricultural and Forestry Experiment Station, West Virginia University.

West Virginia University
Agricultural and Forestry Experiment Station
College of Agriculture and Forestry
Robert H. Maxwell, Interim Director
Morgantown

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FOREWORD

This is the first in a series of reports on West Virginia's forest resources. The series will examine the forest resources, their current levels of utilization, their present role in the state's economy, the outlook for the future, and the prospects for increasing the economic contribution of forests and forest-based activity for the benefit of the citizens of West Virginia.

The reports will focus mainly on timber resources and the timber-based economy. Observations will be included on other forest resources and their uses, including outdoor recreation, fish and wildlife, water, and wilderness; but these will not be covered in depth. Detailed research on the state's nontimber resources and their use is in progress and will be reported separately.

The research reported herein was conducted under auspices of the West Virginia Agricultural and Forestry Experiment Station at West Virginia University. Major financial support was provided by the West Virginia Governor's Office of Economic and Community Development and by the Experiment Station. Other principal cooperators were the West Virginia Department of Natural Resources, the USDA Forest Service, and West Virginia Forests, Inc. The investigators gratefully acknowledge the support and cooperation of these agencies and organizations.

FORESTS AND THE WEST VIRGINIA ECONOMY

I. Forest Land Base, Forest History and Types, Forest Ownership and Inventory

Gary W. Zinn and Kenneth D. Jones

INTRODUCTION

West Virginia comprises an area of 24,199 square miles of hilly to mountainous terrain in the central Appalachians. Bordered on the east by the Blue Ridge Mountains of Virginia and on the west by the Ohio River, the state, which is well known throughout the United States and the world for its vast coal reserves and production of chemicals and heavy metals, has also recovered from past forest exploitation to potentially become a major source of hardwood timber in the United States. West Virginia's 11,484,000 acres of commercial timberland grow over 820 million board feet of new sawtimber annually. Currently this is more than twice that harvested for use as lumber or other wood products each year. With more than 27.6 billion board feet of sawtimber already standing in West Virginia's forests, the potential contribution of timber resource use to the state's economy is considerably greater than present levels of timber-based activity.

THE LAND BASE

West Virginia encompasses 15,408,120 acres of land, including some of the most scenic and rugged mountain terrain in the eastern United States. Of the 48 contiguous states, West Virginia ranks 40th in size. Its land base of 24,199 square miles represents 0.68 percent of the nation's total land area. On a regional basis, West Virginia is fourth in size among the northeast's 12 states, smaller only than Maine, New York, and Pennsylvania.[1] Of the state's total land area, 12.6 million acres (81.86 percent) are covered by forest. This represents 2.35 percent of the nation's commercial forest land and 14.5 percent of the commercial forest land in the northeast. Since 55 percent of the nation's population lives within a 500-mile radius of West Virginia, the state is well located in terms of access to major wood product markets and accessibility for on-site forest uses, such as recreation (10).*

---

[1] The northeastern states are Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and West Virginia.

*Numbers in parentheses at end of sentences and in tables refer to numbers of items in Literature Cited section on pp. 15 and 16.

In 1980, 1,949,600 people were living in West Virginia. This total was an 11.8 percent increase in population since 1970. Of this total, 36.2 percent live in urban areas and 63.8 percent live in rural areas, making West Virginia a predominantly rural state, as it has been throughout its history (21).

Other major land use categories are shown in Appendix Table A-1. It shows that of the state's 15,487,421 acres, 79,301 acres are covered by water in the form of streams, lakes, and reservoirs. This leaves West Virginia with a total land area of 15,408,120 acres. Urban land accounts for 331,091 acres or 2.14 percent of the total acreage statewide.

Historically, much of the state's forested land has been cleared for farming, or has been cut over and burned during the timber boom of the early 20th century. Since the 1940s, however, this trend has reversed, with much abandoned farmland reverting to forest cover. The cover type, stand composition, age, and quality of today's forests are often a direct result of past land use. This influence can easily be seen in the forests of the 1980s. In light of this, it is appropriate to take a brief historical look at West Virginia's forests.

FOREST HISTORY

The original forests which covered the entire land area of what was to become West Virginia were of immense stature and proportion. Individual trees containing 10,000 board feet or more were not uncommon, and stands averaging 40–50 MBF per acre were often recorded by early lumbermen.[2]

Atop the higher mountains and ridges, pure stands of red spruce grew to heights of 100 feet and to common diameters of 4 feet or more. It is estimated that 469,000 acres of the Mountain State were once covered by the original red spruce forests. Volumes of 30–50 MBF per acre were common in this forest type with some estimates ranging to 100 MBF per acre (9).

Lower on the slopes the red spruce gave way to northern hardwoods. They were found at elevations of 2,000 to 3,500 feet and consisted mainly of yellow birch, sugar maple, red maple, beech, and basswood. On moister cove sites stands of yellow-poplar, hemlock, and black cherry became associated with the other northern hardwoods. One yellow-poplar cut in Tucker County filled an entire log train. It contained 12,469 BF; the butt log alone contained 2,916 BF (9).

The oak-chestnut forest type occupied the lower and relatively drier ridges and southern exposures below 2,500 feet. This forest type grew in open stands with little undergrowth and was the most extensive forest cover found in the state. American chestnut was usually the most numerous species of this type, although red oak was also very abundant. However, some of the largest trees in the virgin forest were white oaks. Predominant in the lower, richer soils, white oak often attained diameters of 6 feet and grew to heights of over 100 feet. The largest tree ever cut in West Virginia was a white oak in Tucker County which measured 13 feet in diameter, 16 feet from the base! It was cut in 1913 (9).

---

[2] MBF = thousand board feet.

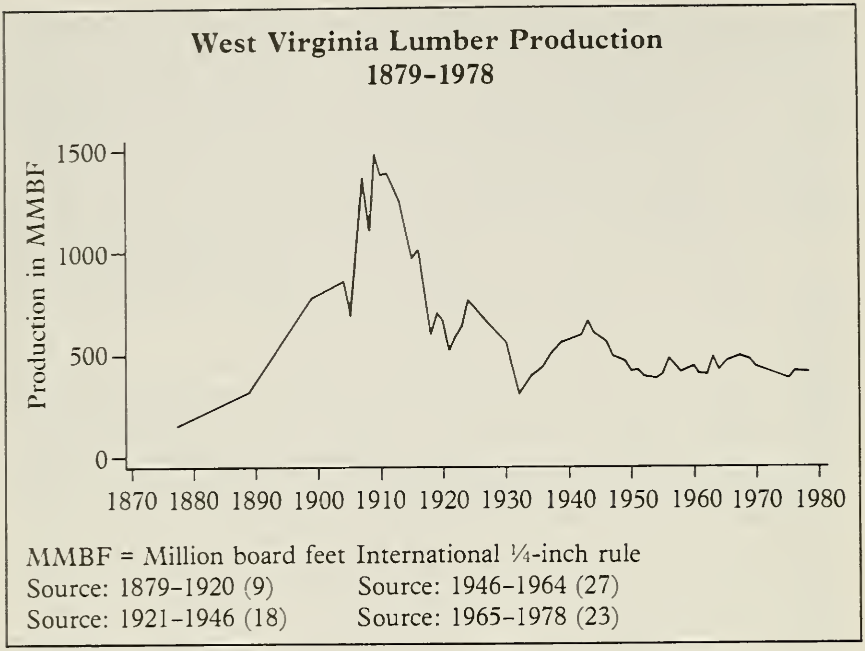
Another common and valuable species of the original forest was Eastern white pine. It was most often found in pure stands along the river bottoms and lower slopes. Extensive stands of white pine existed along the Greenbrier River and its tributaries. Lumbermen estimated this original stand at 600 million BF. Others estimated it at one billion BF. Here and in other parts of the state white pine volumes ran as high as 40,000 BF to the acre.

Other species also reached huge dimensions. Black walnut, cucumbertree, black cherry, basswood, and even sassafras grew to several feet in diameter. Sycamores were perhaps the largest trees in diameter. Some hollow sycamores found along the banks of rivers had recorded diameters of up to 18 feet!

This magnificent forest remained much as it was until well after the Civil War. Most timber removals up to that time resulted from farming activity and small localized sawmill operations. In 1893, George W. Summers reported that "nearly or quite one-half of the state is still uncleared, and by far the greater portion of the uncleared land is still virgin forest" (9). Even by 1910 it was reported that the virgin forest area was slightly over 1.5 million acres. By this time, however, West Virginia was in the midst of a tremendous logging boom. It is estimated that between 1870 and 1920 more than 30 billion board feet of lumber were cut in West Virginia from more than 8,500,000 acres of virgin timber. This amount of lumber would build a boardwalk 13 feet wide and 2 inches thick to the moon. In 1909, the year of highest production, West Virginia ranked 13th among the states in lumber production by cutting 1.473 billion BF of lumber from 1,524 mills. By 1920, the original forest had been completely removed except for some small isolated areas (9).

Although the intensive logging exposed much of the prime forest soil to erosion, perhaps even greater damage was inflicted to the land as a result of fire. Fires, raging through the heavy logging residue, burned so intensely that they consumed the humus, exposing the underlying bedrock and preventing any forest regeneration for years. Erosion of soil from burned over areas further damaged the sites and hindered revegetation. These fires not only ravaged cut-over areas but standing timber as well. The extent of past forest fires in West Virginia is revealed from geologic and economic survey data from the year 1908. In that year, 710 reported fires burned 1,703,850 acres and destroyed 943,515,000 BF of standing timber; that is more than twice the volume of timber cut in 1979 (9).

After the 1920s West Virginia's forest industry was much reduced, consisting mostly of only small-scale operations. The onset of World War II brought about a small but short-lived revival of West Virginia's lumber industry, which produced 891 million BF in 1946. Since 1950, however, the timber harvest in the state has never exceeded 454 million BF, averaging 400 million BF annually (Figure 1).



MMBF = Million board feet International ¼-inch rule
Source: 1879–1920 (9)
Source: 1921–1946 (18)
Source: 1946–1964 (27)
Source: 1965–1978 (23)

Figure 1.

FOREST TYPES

Yet, with time, the renewability of West Virginia's forest resource has asserted itself to the point where today more than 80 percent of the state is again in forest cover of some kind. Of a total forest area of 12,677,780 acres, some 11.5 million acres are classified as commercial timberland producing net growth of 663,600 MBF per year (4). Gradually this even-aged second growth forest has become the predominant land type in the state.

In general, the second growth forests of West Virginia can be divided into three major type groups: (1) the oak-pine forests of the Eastern Panhandle, (2) the mountain forests found in the higher elevations of the Allegheny Mountains, and (3) the mixed central hardwood forests which include several major type groups and cover most of the state (Figure 2). The following discussion of major forest type groups and specific types must be read with the understanding that *diversity* characterizes West Virginia's forests. It is rare for a single tree species—or a small number of species—to occupy a substantial acreage. Typically, the state's forests are a complex mixture of species, which changes frequently as one examines forest sites with different elevations, soil types, slope positions, etc.

Beginning in the east, in the Ridge and Valley province of the Potomac River Basin, the oak-pine type dominates the steeply inclined, shallow-soiled ridges. These relatively dry ridges, which run in a northeasterly-southwesterly direction, receive an average of only 35–40 inches of precipitation per year. Low precipitation, combined with high summer temperatures (average 71° F in July) sometimes produce drought conditions during the late summer months, especially on the southerly exposed slopes. In the winter 24–32 inches of snowfall occurs annually with snow cover lasting for 40–60 days (2). Ice storms and high winds are major causes of tree damage and can usually occur from January to March. Elevations seldom exceed 3,000 feet, allowing a frost-free growing season of about 150 days. Of major importance in the oak-pine type are such dry site species as scarlet oak, black oak, chestnut oak, hickories, and pitch pine. The presence of pine is generally only temporary, resulting from past human influences, and should be replaced in the climax stages by the oaks. Growth rates on the harsher sites with southern exposures are extremely slow. A rotation age for small chestnut oak sawtimber would be about 100 years. Of course, better growth can be expected on the northeastern slopes and the moister, better-protected cove sites.

Towards the west, the oak-pine forests of the Ridge and Valley province give way to the mountain forests characteristic of the cool, wet highlands of the Allegheny Mountains. Here elevations range from 2,500 to almost 5,000 feet and shorter growing seasons and cooler temperatures occur. Annual precipitation ranges from 48–64 inches. Snowfall varies, but generally averages 48–64 inches per year, with snow cover lasting approximately 80 days. Daily temperatures in January average about 30° F while in July about 65° F. Due to the irregular topography and wide elevation ranges, these figures vary widely throughout the mountain region. The growing season at these higher elevations is short, ranging from 120–150 frost-free days per year (2).

The mountain forests in West Virginia occur in two distinct cover types: the red spruce and the northern hardwoods. Occasional stands of red spruce, often with Eastern hemlock as an associate, are found at elevations above 3,500 feet where precipitation is high and competition is low. Although once extensive, the spruce type occurs now only in isolated areas of relatively small acreages. Wildfires, following the heavy logging of red spruce in the past, destroyed not only standing timber and logging residue but the seed source as well, thus explaining the extremely slow return of red spruce to the second growth forest and nearly eliminating its importance as a commercial timber type in West Virginia. The northern hardwoods type group now occupies most of the former spruce sites.

Just below the evergreens and often mixing with them at elevations of 2,000 to 4,000 feet are the northern hardwoods. In this type group, sugar maple, beech, and yellow-birch are the usual dominants. Major associates of these dominant species are basswood, red maple, black cherry, white ash, cucumbertree, red oak, and chestnut oak. Hemlock can also be found among the northern hardwoods. These northern hardwoods typically occupy the 2,000–4,000-foot elevation zone in the Allegheny Mountains, which includes the best sites for tree growth in West Virginia. Annual growth of 200–400 BF per acre is often realized on good sites. With these growth rates, sawtimber size trees can be harvested in only 60 years.

Sloping westward from the Allegheny Mountains to the Ohio River rests the Appalachian Plateau and the mixed hardwood forests. The Plateau, or Hill Country, is characterized by steep slopes and narrow valleys, which become less rugged near the Ohio River. The climatic conditions allow good to excellent tree growth. Here rainfall averages 44–48 inches per year with a mean daily temperature in July of 75° F. In January the mercury hovers around 33° F during the day, allowing the annual snow cover to remain about 60 days. The frost-free growing period is approximately 150 days (2).

The mixed hardwood forests are extremely variable and contain many species associations and forest types. Of major importance on the slopes and hills is the oak-hickory type, consisting mainly of red oak, white oak, chestnut oak, hickories, and other oaks in association with red maple and a wide mix of other species. Another type of major importance is the cove hardwoods. On moist, protected sites, yellow-poplar is usually the dominant species, with black cherry, red oak, red maple, and hemlock also present. A third major type of the mixed hardwood forest is the elm-ash-cottonwood type common to the flood plains of the broader valleys and along the Ohio River. Silver maple and sycamore also form a common sub-type in these valleys. It is important to remember that the mixed hardwood forest is extremely diverse, with more than 50 commercial species forming many combinations over a wide range of site and productivity classes. However, it can generally be said that the region offers good growth conditions with possible sawtimber rotations of 50–75 years.

With so much of West Virginia covered by forests it is difficult to discuss, with any accuracy, the total number of individual tree species and cover types which comprise the whole forest. It is much simpler to determine numbers, however, if only trees and common forest types of commercial interest are considered. Appendix Table A-2 contains a list of individual tree species with commercial value found in West Virginia.

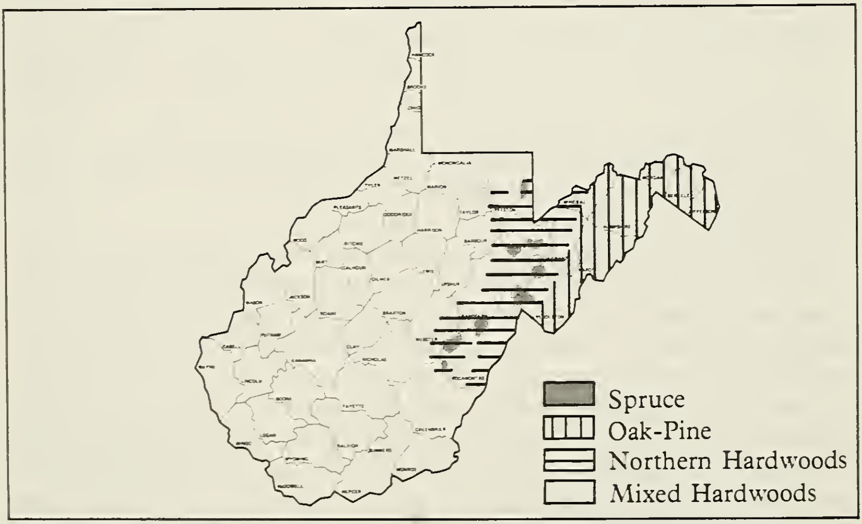


Figure 2. Forest Type Groups in West Virginia.

FOREST LAND BASE

It is important to realize that not all forest land is available for timber production. The term "commercial" is used to define that forest land capable of producing crops of industrial wood, and that has not been protected or withdrawn from possible utilization. The definition of commercial forest land further requires that the land be capable of producing 20 cubic feet of wood per acre per year. Forest land that cannot produce this amount is classified as noncommercial. This category also includes land that can produce 20 cubic feet or more per acre per year but has been withdrawn from possible timber harvesting activity. Examples of noncommercial forest land are state parks, scenic areas, national wilderness areas, and Christmas tree plantations (these land uses are generally called productive-reserved forest land). Acreages of various forest land classes are shown in Table 1.

Table 1

Area by Land Classes, West Virginia 1975

	Area	
Land Class	Thousand Acres	Percent
Forest Land		
Commercial	11,483.7	74
Productive Reserved	115.5	1
Christmas Tree Land	8.9	(a)
Unproductive	24.5	(a)
Non Forest Land	3,781.2	25
Total	15,413.8	100

(a) Represents less than .05 percent.

Source: (4).

In addition, Appendix Tables A-3 and A-4 list the major commercial and noncommercial forest types found throughout West Virginia and their approximate acreages.

OWNERSHIP

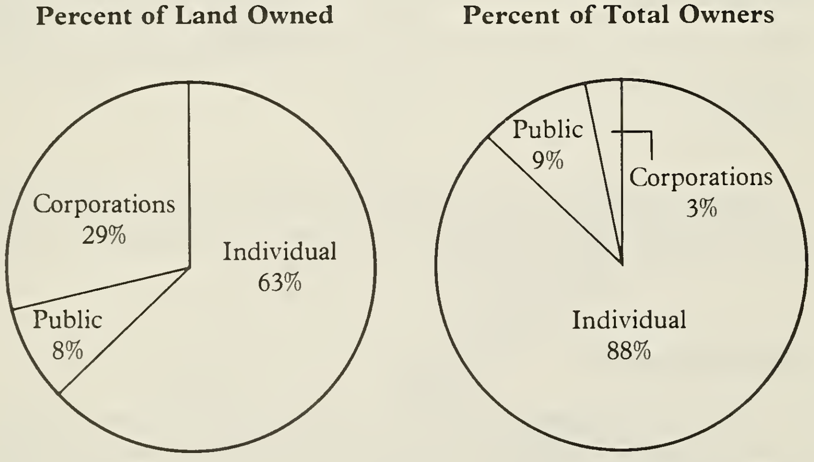
The USDA Forest Service estimates there are 207,500 owners of private commercial forest land in West Virginia. Together, these private ownerships represent 88 percent of all commercial forest land in the state. The average holding is 49.8 acres, but 40 percent of all owners own fewer than ten acres. Thirty percent of the private commercial forest land is owned by fewer than 500 owners or less than 0.2 percent of all owners (3). Most of these large holdings belong to corporations or partnerships. The largest private landowner in West Virginia is Continental Oil Corp., which owned 554,097 acres in 1976 (12).

Basically, landowners in West Virginia can be divided into three major ownership classes—(1) individual ownerships, (2) corporate ownerships, and (3) public ownerships. Individuals own 63 percent of the land and account for an estimated 88 percent of all private ownerships. Corporations, including partnerships, account for ownership of approximately 29 percent of commercial forest land, but include only 3 percent of all owners. Various public holdings in the state amount to about 8 percent of all commercial forests in West Virginia (3). (See Figure 3.)

Individual Ownerships

Individual landowners represent a wide cross-section of the state's population. Various professionals and skilled workers control 26 percent of the forest land owned by individuals and account for 13 percent of the individual ownerships. Farmers account for 16 percent of all individual forest ownerships and control an estimated 22 percent of the forest land owned by individuals. The largest group of individual landowners is comprised of unskilled laborers and retirees. The Forest Service estimates that more than 50 percent of all individual landowners belong to this group. These owners control 37 percent of the commercial forest land (3).

Through use of a questionnaire, Birch and Kingsley (USDA Forest Service) have been able to design a profile of the typical landowner in West Virginia (Table 2).



Source: (3).

Figure 3. Ownership of Commercial Forest Land, West Virginia, 1975.

Table 2

Profile of Typical Landowner in West Virginia, 1975

Age	45–64
Education	0–12 years
Income	Under $15,000
Early life environment	Rural area or farm
Occupation	Laborer-retired
Length of ownership	More than 10 years
Size of tract	Less than 20 acres
Distance to nearest tract	Less than 1 mile
Number of tracts	One
Reasons for owning	Part of residence, farm, domestic use, or esthetic enjoyment

Source: (3).

These "typical" West Virginia landowners have numerous reasons for owning forest land. Among these the most common are that the woodlands were part of their home, residence, or farm; provided acreage for farm use; or for esthetic enjoyment. Only 3 percent of the owners held forest land *primarily* for timber production (3). These owner attitudes may prove to be more important than just the sheer size of commercial forest acreage in West Virginia. After all, it will be the decision of the landowner which ultimately influences West Virginia's ability to earn a reputation as a major timber-producing state.

Corporate Ownerships

Corporations, including partnerships, undivided estates, clubs, associations, and trusts, control 37 percent of privately owned commercial forest land in West Virginia. By themselves, corporate owners control 25 percent. Of the corporate percentage, forest industries own 32 percent or 816,500 acres (3). This group is comprised of less than 50 owners. Nonforest corporations own 963,000 acres, primarily for the coal, oil, gas, and other minerals lying below the surface. In West Virginia, the value of sub-surface minerals often exceeds the value of the surface land. Because of this, mineral ownership is commonly separated from the surface deed. Thus, much of the land in the state has several owners, each with a claim to the same acreage but at different depths. This ownership pattern has sometimes led to serious conflicts involving surface rights of one owner versus the right to extract minerals belonging to another.

Because corporate holdings are so large, they are well suited to intensive forest management and timber harvesting. From this viewpoint the forest industry lands are probably the best-managed forests in the state. In recent years timber removals from these lands have closely paralleled timber growth.

Ninety-three percent of all corporate lands, however, have also supported timber harvesting (3). So, contrary to some who would criticize corporate landholdings for being so large, forestry and timber production appears to be enhanced by these corporate landowners.

Public Ownership

Public lands in West Virginia total some 1,310,769 acres, of which 78 percent are in federal holdings, 21 percent in state ownership, and 1 percent belongs to various counties and municipalities (3). The acreages for each of these public ownership classes can be found in Appendix Table A-5.

The national forest system is, by far, the most important and largest single public landowner in West Virginia. The Monongahela National Forest alone includes 839,630 acres. A large percentage of the most productive land in the state is included in the national forest acreage. The Multiple-Use and Sustained Yield Act of 1960 requires the Forest Service to administer national forest lands for outdoor recreation, range, timber, watershed, and wildlife purposes. Under this management system timber harvesting activity must be tempered by other resource considerations.

State lands include 38 parks and 9 state forests which are managed by the Department of Natural Resources for the enjoyment of all West Virginians. State-owned lands account for 2 percent of all land in the state. With the exception of the state forests, most state-owned land falls into the productive-reserved category for commercial forest lands.

FOREST INVENTORY

In 1974 there were approximately 15,577.7 million cubic feet of timber growing in commercial forests throughout West Virginia. Of this total, about 8,049.1 million cubic feet, or 52 percent, was sawtimber size. Hardwood sawtimber volumes were 25,031.1 million cubic feet, while softwood sawtimber volume was only 2,599.7 million cubic feet, exemplifying the state's potential as a major source of hardwood lumber (Table 3). At current harvest levels it would take approximately 90 years to remove the standing sawtimber volume alone.

Farmers and other individual ownerships contain 75 percent of all cubic foot volume and 73 percent of all sawtimber volume in the state.[3] Yet it is this ownership class that receives the least forest management.

Among forest types, the oak-hickory type, which covers 6.88 million acres, contains more sawtimber volume than all other forest types combined. Some 15,379.5 million BF of sawtimber exist in the oak-hickory forest type (Table 4).

Other forest types with significant volumes of sawtimber are the maple-beech-birch type of the Allegheny Mountain Region, the elm-ash-cottonwood type found along the rivers and broader valleys, and the oak-pine type typical of the Ridge and Valley province of the Potomac River Basin.

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[3] Additional volume information by stand-size and ownership classes can be found in Appendix Table A-6.

But it is not enough to consider volume figures alone; quality is also of considerable economic importance. In West Virginia quality is a problem. Logs are graded according to standardized industry procedures for assessing quality, with Grade 1 representing the highest quality logs. Grade 1 logs are highly sought for veneer and furniture manufacturing. Only 14 percent of all sawtimber volume on commercial forest land in West Virginia qualifies as Grade 1 logs. Seventeen percent is classified as Grade 2, while 69 percent, or 18,576.5 million BF, falls into the lowest quality classes, grades 3 and 4 (4). Table 5 gives the net volume of sawtimber on commercial forest land by species and quality classes. (See also Appendix Table A-7.) The existence of such a large volume of low grade timber presents a considerable obstacle to West Virginia's efforts toward improving the forest economy in the state.

A closer examination of the timber resource will follow in a future forest series publication.

Table 3

Net volume of timber on commercial forest land, by class of timber, softwoods and hardwoods, West Virginia, 1975

(In millions of cubic feet)

Class of timber	All species	Softwoods	Hardwoods
Sawtimber trees:			
Sawlog portion	6,581.9	608.8	5,973.1
Upper-stem portion	1,467.2	84.4	1,382.8
All sawtimber trees	8,049.1	693.2	7,355.9
Poletimber trees	5,466.3	301.8	5,164.5
All growing-stock trees	13,515.4	995.0	12,520.4
Rough trees	1,449.6	76.1	1,373.5
Rotten trees	612.7	13.1	955.6
Total, all trees	15,577.7	1,084.2	14,493.5

Source (4).

ECONOMICS AND COMMENTS

Presently, the total size of the forest-based economy in West Virginia is unknown. But the wood products industry alone generates about the same amount of economic activity as the oil and gas industry in the state. For example, in 1981 it was estimated that the wood products industries purchased $232 million in materials, shipped $424.4 million worth of products, and added $196 million of value in manufacture, while paying in wages and salaries $135.1 million to 16,713 employees (28).

Table 4

Net volume of growing stock and sawtimber on commercial forest land, by forest types, and softwoods and hardwoods, West Virginia, 1975

Forest type	Growing stock			Sawtimber		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Million cubic feet			*Million board feet*[1]		
White and red pine	183.2	114.9	68.3	321.4	204.6	116.8
Spruce-fir	151.3	97.2	54.1	461.6	351.5	110.1
Virginia and pitch pine	430.2	277.1	153.1	809.8	595.1	214.7
Oak-pine	558.5	192.8	365.7	1,174.2	502.2	672.0
Oak-hickory	7,722.1	137.3	7,584.8	15,379.5	373.5	15,006.0
Elm-ash-cottonwood	764.6	13.3	751.3	1,403.8	41.1	1,362.7
Maple-beech-birch	3,705.5	162.4	3,543.1	8,080.5	531.7	7,548.8
All types	13,515.4	995.0	12,520.4	27,630.8	2,599.7	25,031.1

[1] International ¼-inch rule.

Source: (4).

Table 5

Grade of softwood and hardwood sawtimber inventory, West Virginia, 1975.
(In millions of board feet)

Timber type	All Classes	Standard Lumber Logs Grade 1	Grade 2	Grade 3	Grade 4
Softwoods	2,599.7	56.8	117.5	1,304.9	53.0
Hardwoods	25,031.1	3,432.5	4,380.0	11,496.0	5,722.6
			Percent		
Hardwood Quality	100	14	17	46	23

Source: (4).

In addition to the wood products industries, other forest-based industry also contributes significantly to the state economy. The recreation industry, with an estimated employment of 40,000, is broad and includes travel and tourism, skiing, whitewater rafting, camping, hunting, fishing, and many other outdoor activities. In recent public advertisements Governor Rockefeller estimated the tourism contribution to the state economy at $1.4 billion per year. However, a more recent publication ranked West Virginia 38th in the nation in tourism dollars, crediting the state with a $1.1 billion tourism industry employing 29,700 people (16). The multitude of forest recreation opportunities is a major reason why this industry has become so large and shows so much more potential. Although accurate figures are not available for many revenue-generating forest activities, a few segments of the recreation industry do provide some interesting figures.

In 1983, almost 8.5 million people visited state parks, forests, and wildlife areas. In 1980, user fees from these areas amounted to about $8.7 million. The Department of Natural Resources estimates that overall the West Virginia park system contributes $49 million annually to the state economy (13). However, these figures do not include use of national forest recreation areas. In 1980, over 1.2 million visitor use days were recorded on the national forests in West Virginia (8). Even though the state does not receive any direct user fees from those recreation areas, it does receive annual in-lieu payments from the national forest to be used in place of property tax revenues in those counties containing national forest system land.[4]

Another important revenue-generating activity is whitewater rafting. In 1982, 175,000 people participated in the sport. It is estimated that the rafting industry brings $30–50 million to the state annually (6).

Also in 1982, $7,637,273 was collected from the sale of 849,318 hunting and fishing licenses. The Department of Natural Resources calculates that $309 million is spent each year on wildlife-related recreation. In 1983, deer hunters spent over $70 million on equipment, services, and licenses in West Virginia. The deer harvested that year represented $8.4 million when converted to usable venison (13).

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[4] Legally, local property taxes cannot be levied on federally owned property.

In addition to hunting, fishing is a significant economic contributor. In 1982 the Mountain State's lakes and streams provided some 346,584 anglers with 9 million man-days of fishing activity. These same fishermen spent an estimated $136 million dollars while sport fishing (13).

The forests also see extensive use through such nonconsumptive activities as hiking, birdwatching, and photography. Nonconsumptive users were estimated to number 1,421,900 in 1980. It is certain that these users contribute significantly to the economic picture, although the exact amount is unknown (15).

Despite such heavy use, the forests of West Virginia seem to be supporting this activity with little effort. In fact, the forests are growing in both volume and acreage every year. The potential use and revenue-generating opportunities of this unique resource have barely been tapped. It has been suggested that the state's wood industry could expand three to four times its present size, considering the volume of the timber resource. Even a modest increase of only two times could bring an additional 17,000 jobs to the state (28).

The forests of West Virginia have shown that even after abuse they have the ability to renew themselves. This is not to suggest that the forest should be overexploited; rather, more attention should be directed towards the forests as a means of strengthening and expanding the state's economy. No other natural resource in the state can offer the abundance and diversity of raw materials, jobs, recreational opportunities, wildlife, drinking water, and aesthetic values as do the forests of West Virginia.

With the state experiencing such financial difficulties as evidenced in the past few years, West Virginia lawmakers, businessmen, and citizens should begin working toward a strong forest economy as a means of easing the hard times being experienced by many West Virginians. The forests are here, yet their full potential economic contribution is unrealized. In this light, perhaps it could be said that many West Virginians haven't seen the forests for the trees.

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APPENDIX A

Tables

A-1 Land-Use Statistics for West Virginia, 1980.
A-2 Commercial Tree Species of West Virginia.
A-3 Area of Commercial Forest Land by Local Forest Types and Major Forest Types, West Virginia, 1975.
A-4 Area of Noncommercial Forest Land by Forest Types, West Virginia, 1975.
A-5 Public Lands, West Virginia, 1975.
A-6 Net Volume of Growing Stock and Sawtimber on Commercial Forest Land by Ownership Classes, Stand-size Classes, Softwoods and Hardwoods, West Virginia, 1975.
A-7 Net Volume of Sawtimber on Commercial Forest Land by Species and Quality Classes, West Virginia, 1975.

Table A-1

Land-Use Statistics—Statewide

Land-Use Category	Acreage	Percent Statewide	Percent Within Category
1 Urban or Built-up Land	331,091	2.14	
11 Residential	214,519		64.79
12 Commercial and Services	31,948		9.65
13 Industrial	29,634		8.95
14 Transportation, Communications, and Utilities	29,091		8.79
15 Industrial and Commercial Complexes	0		0.00
16 Mixed Urban or Built-up Land	11,162		3.37
17 Other Urban or Built-up Land	14,737		4.45
2 Agricultural Land	2,246,259	14.50	
21 Cropland and Pasture	2,224,677		99.04
22 Orchards, Groves, Vineyards, Nurseries, and Ornamental Horticultural Areas	20,283		0.90
23 Confined Feeding Operations	80		0.004
24 Other Agricultural Land	1,219		0.05
3 Rangeland	207	0.001	
31 Herbaceous	0		0.00
32 Shrub and Brush	207		100
33 Mixed	0		0.00

(continued)

Table A-1 (continued)
Land-Use Statistics—Statewide

Land-Use Category	Acreage	Percent Statewide	Percent Within Category
4 Forest Land	12,677,780	81.86	
41 Deciduous	8,827,388		69.63
42 Evergreen	97,348		0.77
43 Mixed	3,753,044		29.60
5 Water	79,301	0.51	
51 Streams and Canals	14,768		18.62
52 Lakes	287		0.36
53 Reservoirs	64,246		81.02
54 Bays and Estuaries	0		0.00
6 Wetland	10,846	0.07	
61 Forested	2,198		20.27
62 Nonforested	8,648		79.78
7 Barren Land	141,937	0.92	
74 Bare Exposed Rock	0		0.00
75 Strip Mines, Quarries, and Gravel Pits	97,635		68.79
76 Transitional Areas	44,302		31.21
Total Acreage	15,487,421		

Source: (25)

Table A-2
Commercial Tree Species of West Virginia

Scientific name*	Common name	Occurrence**
	Softwoods	
Abies balsamea	Balsam fir	r
Juniperus virginiana	Eastern redcedar	r
Picea rubens	Red spruce	r
Pinus echinata	Shortleaf pine (Yellow)†	r
P. pungens	Table-Mountain pine	r
P. resinosa	Red pine	vr
P. rigida	Pitch pine	r
P. strobus	Eastern white pine	c
P. sylvestris	Scotch pine‡	vr
P. virginiana	Virginia pine (Scrub)	c
Thuja occidentalis	Northern white-cedar	vr
Tsuga canadensis	Eastern hemlock	c
	Hardwoods	

Table A-2 (continued)

Commercial Tree Species of West Virginia

Scientific name*	Common name	Occurrence**
Acer rubrum	Red maple (Soft)	vc
A. saccharinum	Silver maple	vr
A. saccharum	Sugar maple (Hard)	vc
Aesculus species	Buckeye	r
Betula alleghaniensis	Yellow birch	c
B. lenta	Sweet birch (Black)	c
B. nigra	River birch (Red)	vr
B. papyrifera	Paper birch (White)	vr
Carya species	Hickory	vc
Castanea dentata	American chestnut	r
Celtis occidentalis	Hackberry (Sugar berry)	r
Cornus florida	Flowering dogwood	c
Diospyros virginiana	Common persimmon	r
Fagus grandifolia	American beech	c
Fraxinus species	Ash	c
Gleditsia triacanthos	Honeylocust	vr
Ilex opaca	American holly	vr
Juglans cinerea	Butternut	r
J. nigra	Black walnut	c
Liquidambar styraciflua	Sweetgum	vr
Liriodendron tulipifera	Yellow-poplar (Tuliptree)	vc
Magnolia species	Magnolia	c
Nyssa sylvatica	Blackgum (Tupelo)	c
Platanus occidentalis	American sycamore (Buttonwood)	r
Populus deltoides	Eastern cottonwood	vr
P. grandidentata	Bigtooth aspen (Popple)	r
P. tremuloides	Quaking aspen (trembling)	r
Prunus serotina	Black cherry	c
Quercus alba	White oak (Stave)	vc
Q. bicolor	Swamp white oak	vr
Q. coccinea	Scarlet oak	c
Q. imbricaria	Shingle oak	vr
Q. macrocarpa	Bur oak	vr
Q. muehlenbergii	Chinkapin	vr
Q. palustris	Pin oak	vr
Q. prinus	Chestnut oak (Rock)	vc
Q. rubra	Northern red oak	c
Q. stellata var. stellata	Post oak	r
Q. velutina	Black oak (Yellow bark)	c
Robinia pseudoacacia	Black locust	c

(continued)

Table A-2 (continued)

Commercial Tree Species of West Virginia

Scientific name*	Common name	Occurrence**
Salix nigra	Black willow	vr
Tilia americana	American basswood (Linden)	c
Ulmus species	Elm	c

*Name according to: Little, Elbert L., Jr., Checklist of Native and Naturalized Trees of the United States (including Alaska). U.S. Dept. Agric. Handb. 41. 472 p. 1953.

**Occurrence is based on the frequency at which the species was encountered on forest survey field plots: vr—very rare, r—rare, c—common, and vc—very common.

†Names in parenthesis are other frequently used common names.

‡Species introduced into West Virginia.

Source: (4).

Table A-3

Area of commercial forest land by local forest types and major forest types, West Virginia, 1975.

(In thousands of acres)

Local forest type and major forest type	Area
White pine	37.9
Hemlock	63.3
Total, white and red pine	101.2
Red spruce-balsam fir	59.0
Total, spruce-fir	59.0
Shortleaf pine	12.2
Virginia pine	450.9
Pitch pine	22.1
Total, Virginia and pitch pine	485.2
White pine-northern red oak-white ash	27.6
Virginia pine-southern red oak	396.7
Shortleaf pine-hardwoods	36.1
Other oak-pine	107.8
Total, oak-pine	568.2
Post, black, or bear oak	349.1
Chestnut oak	1,062.2
White oak-red oak-hickory	1,594.4
White oak	706.5
Northern red oak	242.8
Yellow-poplar—white oak—no. red oak	572.8

Table A-3 (continued)

Area of commercial forest land by local forest types and major forest types, West Virginia, 1975.

(In thousands of acres)

Local forest type and major forest type	Area
Sweetgum—yellow-poplar	683.6
Mixed hardwoods	1,616.7
Total, oak-hickory	6,828.1
Black ash-elm-red maple	764.9
River birch-sycamore	49.6
Total, elm-ash-cottonwood	814.5
Sugar maple-beech-yellow birch	2,422.9
Black cherry	152.7
Black walnut	43.0
Total, maple-beech-birch	2,618.6
Aspen	8.9
Total, aspen-birch	8.9
All types	11,483.7

Source: (4).

Table A-4

Area of noncommercial forest land, by forest types, West Virginia, 1975.

(In thousands of acres)

Forest type	All areas	Productive-reserved areas	Unproductive areas
Spruce-fir	8.0	3.0	5.0
Virginia and pitch pine	17.3	11.4	5.9
Oak-pine	12.5	.9	11.6
Oak-hickory	51.8	50.8	1.0
Elm-ash-cottonwood	1.8	1.8	——
Maple-beech-birch	57.5	56.5	1.0
All types	148.9	124.4	24.5

Source: (4).

Table A-5

Public Lands, West Virginia, 1975

Land Class	Area (acres)	Total (acres)
National Forest		958,261
Monongahela	839,630	
George Washington	100,386	
Jefferson	18,245	
State		281,230
Public Hunting and Fishing	138,748	
State Parks	65,621	
State Forest	76,861	
Corps of Engineers		59,175
National Parks		1,279
Fish and Wildlife Services		215
City and County		10,609
Total Public Lands		1,310,769
Wilderness Areas		
Otter Creek	20,000	
Dolly Sods	10,215	
Cranberry	35,864	
Laurel-Fork North	6,055	
Laurel-Fork South	5,997	
Existing Pioneer Areas		
Seneca Creek	11,600	
Hopeville Gorge	3,600	
Smoke Hole	6,100	
Total Wilderness and Pioneer Areas		99,431

Source: (19) and (8).

Table A-6

Net volume of growing stock and sawtimber on commercial forest land, by ownership classes, stand-size classes softwoods and hardwoods, West Virginia, 1975.

Ownership or stand-size class	Growing stock (million cubic feet)			Sawtimber (million board feet)*		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
By Ownership Classes						
National Forest	1,886.8	217.8	1,669.0	4,180.9	734.2	3,446.7
Other public	295.0	16.1	278.9	537.6	47.8	489.8
Forest industry	1,178.2	87.8	1,090.4	2,765.6	274.8	2,490.8
Farmer and other	10,155.4	673.3	9,482.1	20,146.7	1,542.9	18,603.8
All ownerships	13,515.4	995.0	12,520.4	27,630.8	2,599.7	25,031.1
By Stand-Size Classes						
Sawtimber stands	8,532.5	660.1	7,872.4	21,655.1	2,023.8	19,631.3
Poletimber stands	4,205.3	273.8	3,931.5	4,837.2	435.1	4,402.1
Sapling-seedling stands	766.2	61.1	705.1	1,116.8	140.8	976.0
Nonstocked areas	11.4	—	11.4	21.7	—	21.7
All classes	13,515.4	995.0	12,520.4	27,630.8	2,599.7	25,031.1

*International ¼-inch rule.

Source: (4).

Table A-7

Net volume of sawtimber on commercial forest land, by species and quality classes, West Virginia, 1975.

(In millions of board feet)*

		Standard Lumber Logs			
Species	All Classes	Grade 1	Grade 2	Grade 3	Grade 4**
Softwoods:					
White pine	328.8	22.1	68.7	185.0	53.0
Virginia pine	903.2	16.5	27.1	859.6	—
Other yellow pines	300.2	18.2	21.7	260.3	—
Other softwoods†	1,067.5	—	—	—	—
Total softwoods	2,599.7	56.8	117.5	1,304.9	53.0
Hardwoods:					
Select white oaks	2,668.1	182.0	431.1	1,370.6	684.4
Select red oaks	3,203.8	742.4	706.0	1,341.3	414.1
Other white oaks	2,768.6	297.3	518.6	1,289.8	662.9
Other red oaks	3,354.4	495.4	533.1	1,434.1	891.8
Red maple	1,085.9	123.6	145.7	545.8	270.8
Sugar maple	1,158.0	144.3	187.9	545.2	280.6
Yellow birch	164.8	25.5	28.6	76.5	34.2
Sweet birch	228.2	26.6	44.7	114.5	42.4
Hickory	1,720.6	161.0	237.3	799.2	523.1
Beech	1,459.3	120.7	193.2	691.3	454.1
Ash	591.0	79.2	137.7	261.4	112.7
Black walnut	206.8	5.2	27.5	131.4	42.7
Yellow-poplar	3,267.7	658.8	600.0	1,337.3	671.6
Cucumbertree	247.3	23.2	47.5	125.0	51.6
Blackgum	296.1	54.7	76.7	125.9	38.8
Black cherry	1,112.1	169.7	218.9	483.8	239.7
Basswood	417.5	57.1	95.7	203.3	61.4
Other hardwoods	1,080.9	65.8	149.8	619.6	245.7
Total hardwoods	25,031.1	3,432.5	4,380.0	11,496.0	5,722.6
			Percent		
Hardwood quality	100	14	17	46	23

*International ¼-inch rule.

**Grade 4 applies only to white pine. For hardwoods the volumes in this column are for construction logs.

†Species other than pine are not graded into standard-lumber grades.

Source: (4).

APPENDIX B

Definition of Terms*

Land Area Classes

Land area. (a) Bureau of the Census: The area of dry land and land that is temporarily or partly covered by water, such as marshes, swamps, and river flood plains, streams, sloughs, estuaries, and canals that are less than ⅛ statute mile in width; and lakes, reservoirs, and ponds that are less than 40 acres in area. (b) Forest Survey: The same as Bureau of Census, except that the minimum width of streams, etc. is 120 feet, and the minimum size of lakes, etc. is 1 acre.

Forest land. Land that is at least 16.7 percent stocked (contains at least 7.5 square feet of basal area) by forest trees of any size, or that formerly had such tree cover and is not currently developed for nonforest use.

Commercial forest land. Forest land that is producing or capable of producing crops of industrial wood (more than 20 cubic feet per acre per year) and is not withdrawn from timber utilization. (Industrial wood: all round-wood products except fuelwood.)

Noncommercial forest land. Forest land that is incapable of yielding timber crops because of adverse site conditions (unproductive forest land), and productive forest land that is withdrawn from commercial timber use (productive-reserved land).

Productive-reserved forest land. Forest land that is sufficiently productive to qualify as commercial forest land, but is withdrawn from timber utilization through statute, administrative designation, or exclusive use for Christmas tree production.

Tree Classes

Commercial species. Tree species presently or prospectively suitable for industrial wood products. Excludes species of typically small size, poor form, or inferior quality, such as hawthorne and sumac.

Softwoods. Coniferous trees that are usually evergreen, having needles or scalelike leaves; spruce, pines, and hemlocks for example.

Hardwoods. Dicotyledonous trees that are usually broad-leaved and deciduous; oaks, maples, and hickories for example.

Growing stock trees. Live trees of commercial species that are classified as sawtimber, poletimber, saplings, and seedlings; that is, all live trees of commercial species except rough and rotten trees.

Sawtimber trees. Live trees of commercial species, (a) that are of the following minimum diameters at breast height—softwoods 9.0 inches and hardwoods 11.0 inches, and (b) that contain at least one 12-foot or two noncontiguous 8-foot merchantable sawlogs.

Poletimber trees. Live trees of commercial species that are of merchantable quality and are at least 5.0 inches dbh but are smaller than sawtimber size.

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*All definitions from source (4) unless indicated otherwise.

Saplings. Live trees of commercial species that are 1.0 to 5.0 inches in diameter at breast height and of good form and vigor.

Timber Measurement and Volume

Diameter at Breast Height (dbh). The diameter outside bark of a standing tree measured at 4.5 feet above the ground.

Board Foot. A unit of lumber measurement 1 foot long, 1 foot wide, and 1 inch thick, or its equivalent. By forest survey convention, softwoods less than 9.0 inches and hardwoods less than 11.0 inches dbh do not contain board foot volume.

International ¼-inch rule. A log rule, or formula, for estimating the board foot volume of logs, and is used as the USDA Forest Service standard log rule in the Northeastern United States.

Sawlog. A log that meets minimum standards of diameter, length, and defect, including logs at least 8 feet long, and with a minimum diameter inside bark of 6 inches for softwoods and 8 inches for hardwoods.

***Log Grade.* A classification of logs based on external characteristics as indicators of quality or value.

***Net annual growth.* The annual change in volume of sound wood in live sawtimber and poletimber trees resulting from natural causes.

**Source (20).

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Authors

Gary W. Zinn is associate forest scientist and Kenneth D. Jones is research technologist in the Division of Forestry, West Virginia Agricultural and Forestry Experiment Station, West Virginia University.

West Virginia University
Agricultural and Forestry Experiment Station
College of Agriculture and Forestry
Robert H. Maxwell, Interim Director
Morgantown

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FOREWORD

This is the second in a series of reports on West Virginia's forest resources. The series examines the forest resources, their current levels of utilization, their present role in the state's economy, the outlook for the future, and the prospects for increasing the economic contribution of forests and forest-based activity for the benefit of the citizens of West Virginia.

This series of reports focuses mainly on timber resources and the timber-based economy. Observations will be included on other forest resources and their uses, including outdoor recreation, fish and wildlife, water, and wilderness; but these will not be covered in depth. Detailed research on the state's nontimber resources and their use is in progress and will be reported separately.

The research reported herein was conducted under auspices of the West Virginia Agricultural and Forestry Experiment Station at West Virginia University. Major financial support was provided by the West Virginia Governor's Office of Economic and Community Development and by the Experiment Station. Other principal cooperators include the West Virginia Department of Natural Resources, the USDA Forest Service, and the West Virginia Forestry Association. The investigators gratefully acknowledge the support and cooperation of these agencies and organizations.

HIGHLIGHTS

1. West Virginia's 11.4 million acres of commercial forest land contained an inventory of 13.5 billion cubic feet of growing stock and 27.5 billion board feet of sawtimber in 1975.
2. West Virginia has 5.1 percent of the United States' hardwood growing stock, the fifth highest volume of any state.
3. West Virginia's forest lands are highly productive, with 4.76 million acres of commercial forest land capable of growing 85 cubic feet or more of wood per acre per year (almost 6 percent of all forest land in the nation).
4. The oak-hickory forest type dominates West Virginia's hardwood forests, covering 6.8 million acres with 15.5 billion bd. ft. of sawtimber inventory in 1975. Softwoods are of relatively minor importance, occupying only about 0.7 million acres and containing 2.6 billion bd. ft. of sawtimber.
5. Between 1949 and 1975, West Virginia's growing stock inventory increased 90 percent, from 7.1 to 13.5 billion cu. ft. Since annual removals are less than one-half of annual growth, the state's forests are expected to contain about 16.9 billion cu. ft. of growing stock in 1985, with sawtimber volumes of about 30.7 billion bd. ft. This pattern of growth exceeding removals is expected to continue for the next twenty years.
6. Over 90 percent of West Virginia's commercial forest land is in private ownerships. Private landowners who may be expected to manage and harvest their timber controlled about 8.7 billion cu. ft. of growing stock and 17.6 billion bd. ft. of sawtimber in 1975, representing 64 percent of the state's total inventory of both. The inventory and growth rates on these lands greatly exceed present timber removals, indicating that the state's available timber supply could readily sustain a wood-using industry of at least twice the present size.
7. By the year 2000, demand for hardwood timber is expected to reach 6 billion cu. ft., more than twice that of 1975. Thus, West Virginia, with its impressive hardwood timber inventory, is in a very favorable position to enter a period of significant growth in the size and diversity of its timber-based economy.

FORESTS AND THE WEST VIRGINIA ECONOMY

2. The Timber Resource

Gary W. Zinn and Kenneth D. Jones

INTRODUCTION

Since its almost total liquidation in the early 1900s, West Virginia's timber resource base has made a remarkable regrowth. In 1975, the state's inventory of forest growing stock was estimated at 13.5 billion cubic feet and sawtimber volume was estimated to be over 27.5 billion board feet [2]. Thus timber is once again, as it was at the beginning of the twentieth century, one of West Virginia's most conspicuous natural resources, with the potential to contribute greatly to the state's economic well-being.

Such tremendous volumes of any resource cannot long be overlooked by opportunistic businessmen, with the probable long-run result being that a larger, more diversified forest-based industry will gradually develop in West Virginia. But the state, which has never enjoyed a stable economy and which has suffered several recessions during the past decade, cannot afford to wait for dollars to begin falling from the trees. It must actively seek to encourage new and established forest businesses to operate and expand in West Virginia. This would bring much-needed jobs, income, and tax revenue to a state that has led the nation in unemployment for almost two years.

The first step in such a process is to develop and maintain an up-to-date, accurate accounting of the state's timber inventory. This task has been ably conducted by the U.S. Forest Service in cooperation with the State Department of Natural Resources. The first comprehensive statewide timber inventory was conducted in 1949, the second in 1961. The third and most recent forest survey occurred in 1974–75. These forest surveys, conducted under the authority of the McSweeney-McNary Forest Research Act of 1928, require several years of planning, field work, and analysis before reaching publication. Thus, even though the next statewide survey is to begin in 1986–87, it will be several years before the results are available to the public.[1] The latest and most accurate timber inventory data, then, comes from the 1974–75 forest survey, with some projections to 1985 and beyond.

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[1] The U.S. Forest Service will conduct, on a cost-sharing basis, a "mid-term update" of a state's timber inventory, to provide a more current data base than is afforded by the 10–12-year regular inventory cycle. West Virginia did not contract for an update between the 1974–75 and 1986–87 inventories.

THE TIMBER RESOURCE IN PERSPECTIVE

In 1975 the forest acreage in West Virginia totaled 11.6 million acres. Of this total, 11.4 million acres (98.7 percent) is classified as commercial forest land [2]. This land is potentially available for timber harvesting and is the source from which the timber industry can draw its needed raw material. This acreage represents 2.4 percent of all commercial forest land in the United States. Although West Virginia ranks only 41st among the states in total land area, it ranks 25th in total commercial forest land and 17th in total sawtimber acreage (see Appendix Table A1).

In addition to West Virginia's favorable ranking in commercial forest acreage, it is also outstanding in terms of timber volume. Overall West Virginia has 2 percent of all U.S. timber growing stock volume, twentieth highest of all the states. In hardwood growing stock volume West Virginia is fifth in the nation with 5.1 percent of the U.S. total. It is also among the top ten states in terms of hardwood sawtimber volume, ranking eighth in the nation with more than 26 billion board feet of hardwood sawtimber standing in its forests [8].

In the northeast,[2] West Virginia has 14.5 percent of the commercial forest land and 16.42 percent of the sawtimber acreage, ranking fourth and third, respectively. The Mountain State also has 21.92 percent of the northeast's hardwood sawtimber volume, placing it second behind the region's leader, Pennsylvania [8].

Another measure of West Virginia's timber industry potential, and one that is often used to describe a business's vitality, is productivity. West Virginia has 5.04 percent of the most highly productive land in the eastern forest ecosystem[3] and 2.26 percent of the highest land productivity class in the nation. West Virginia also has 5.97 percent of all forest land in the nation capable of producing 85 cubic feet or more of wood per acre per year (see Table 1). The productive capability of the state's forest land is largely responsible for the economic potential of its second-growth forests.

GROWING STOCK VOLUMES

The latest forest survey of 1975 found 15.6 billion cubic feet of timber in West Virginia's forests, of which 87 percent, or 13.5 billion cubic feet, represented the state's growing stock. In addition to growing stock, 1.4 billion cu. ft. of sound wood in rough trees and 613 million cu. ft. of sound wood in rotten trees was also inventoried. Statewide, volume per acre averaged 1,177 cu. ft., while sawtimber volumes averaged 2,406 bd. ft. per acre. Oaks accounted for 40 percent of all growing stock volume and 43 percent of all sawtimber volume. National forest lands and forest industry lands both had per acre volumes considerably higher than the state average; but 84 percent of all growing stock volume and 83 percent of all sawtimber volume still belonged to nonindustrial private owners [2].

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[2] See definition of terms.

[3] Eastern forest ecosystem—see definition of terms, Appendix C.

Table 1
A national and regional comparison of commercial forest land area in West Virginia by productivity class, 1977

Productivity Class[a]	Area[b]	% of Forestland in Nation	% of Eastern Forest Ecosystem[c]	% of Northeast[d]
120+ cu. ft.	1.04	2.26	5.04	15.93
85–120	3.72	3.71	4.76	16.22
50–85	4.76	2.32	2.87	15.85
less than 50	1.97	0.54	2.08	9.98
all classes	11.49	2.40	3.20	14.50

Source: [3] and [8].

[a] Productivity class—cubic feet per acre per year.

[b] Area—millions of acres.

[c] Eastern forest ecosystem—see definition of terms.

[d] Northeast—note: lies entirely in the eastern forest ecosystem.

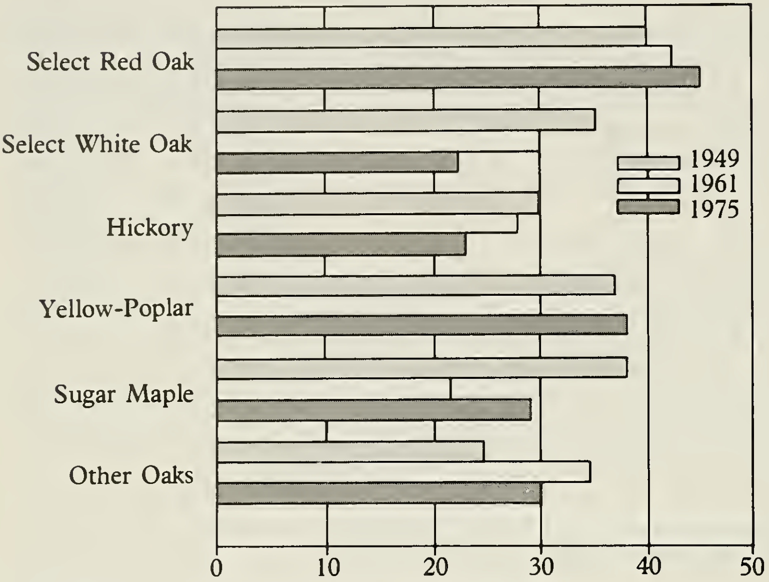
STOCKING AND QUALITY

In forestry, stocking is a measure of how efficiently a given site is being utilized by present tree growth. An acre is considered fully stocked if it contains 75 to 100 square feet of basal area. In 1975, 82 percent of commercial forest land in West Virginia was either fully stocked or overstocked with live trees. However, one out of every four hardwood trees and one out of every eight softwood trees were either poorly formed, highly defective, or otherwise unmerchantable. Consequently, only 30 percent of the commercial forest land in West Virginia was, in 1975, fully stocked with "growing stock" trees, i.e., sound, well-formed trees of merchantable species [2].

In West Virginia sawlog quality is a major concern since the state's main wood product is high quality lumber which necessarily comes mostly from high quality logs. Although there has been an increase in the volume of sawlogs which meet grade specifications, 46 percent of the net sawtimber volume on commercial forest land is in grade 3 logs, while only 31 percent of the sawlog volume is in grades 1 and 2 [2]. This problem, however, may be partially corrected by nature if given some time. The large proportion of grade 3 hardwood logs is directly related to the large volume in 12- to 14-inch dbh trees (see Appendix Table A2). The standardized log grade rule excludes these trees from higher quality classes because of their size. As the forests age, many of these trees will increase in diameter and improve in quality. In addition, thinnings and other silvicultural practices offer a promise of improved quality.

Despite this large percentage of low grade logs, West Virginia still has 7.8 billion board feet of sawtimber in grades 1 and 2. The percentage of fine hardwood sawtimber volume in grades 1 and 2 during the last quarter century is shown in Figure 1.

Figure 1. Quality of hardwood sawtimber in West Virginia; 1949, 1961, and 1975.



Source: [2]. Percent of volume in Grades 1 & 2

Table 2

Components of average annual change of growing stock and sawtimber on commercial forest land, West Virginia, 1960–74

Components	Growing Stock	Sawtimber
	Thousand cubic feet	*Thousand board feet*[b]
Growth on initial inventory[a]	232,800	372,000
Ingrowth—trees entering the volume class	178,100	448,100
Gross growth	410,900	820,100
Cull increment	–53,900	–80,300
Annual mortality	–49,200	–76,200
Average annual net growth	307,800	663,600
Average annual removals	–119,300	–257,000
Average annual change	188,500	406,600

Source: [2].

[a] Including growth on trees that were subsequently cut.

[b] International ¼-inch rule.

GROWTH AND MORTALITY

From 1961 to 1974 West Virginia growing stock increased 2.6 billion cubic feet to a total of 13.5 billion cubic feet. This increase represented an average annual gross growth of 411 million cubic feet. From 1949 to 1975 sawtimber volumes increased 10.1 billion board feet, with an average annual net growth of 663.6 million board feet from 1960 to 1975 [2].

In the past 25 years timber removals have only amounted to about one half of the annual gross growth in West Virginia. This has allowed West Virginia's forests to "grow" with an average annual net change of 188 million cubic feet of growing stock and 407 million board feet of sawtimber from 1960 to 1974 (see Table 2).

In the period between the second and third forest surveys, ingrowth accounted for 43 percent of average annual gross growth in growing stock and 55 percent of average annual gross growth in sawtimber volume. Annual mortality and the cull increment in sawtimber-size trees decreased the gross growth of this class by 19 percent. Sawtimber trees, however, still produced an average annual net growth of 663 million board feet [2].

Growth has not been uniform throughout the range of tree species, however. Natural growth, of course, is determined by many factors inherent to each species; some naturally grow faster than others. In 1974, the combined oak group accounted for 39 percent of total hardwood net growth, but yellow-poplar had the greatest volume of growing stock growth for any single species.

Net annual growth, however, can be substantially reduced or completely negated by the harvest levels experienced by each species. Some highly sought commercial woods such as hickory and sugar maple actually suffered an annual decline in volume due to removals. So, despite the tremendous volumes of overall forest growth occurring in West Virginia, some commercial species are actually being depleted (see Appendix Table A3).

THE COMMERCIAL FOREST

The major commercial forest type in West Virginia is the oak-hickory type, which covers 6.83 million acres of the state and is estimated to include 15.5 billion board feet of sawtimber. This type occupies 60 percent of the commercial forest area, but despite an overall increase in hardwood acreage during the past 25 years, the oak-hickory type has remained relatively stable. Combined, the oaks account for 42 percent of hardwood removals [2].

Unlike the oaks, the maple-beech-birch type has increased in acreage since the first survey. It now covers about 2.62 million acres and is the second most voluminous type, with over 8.08 billion board feet of sawtimber [2].

From these and other hardwood types there are several species which exhibit wood properties that are highly desirable for use in veneers, furniture manufacture, and other specialty products. These are known as fine hardwoods.[4] West Virginia has substantial volumes of these fine woods and plays a significant role in supplying the raw material needs of the fine hardwood market. Nearly 66 percent of the state's hardwood lumber output goes to the fine hardwood market [3]. (See Appendix Table A4.)

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[4] Fine hardwoods—see definition of terms.

The softwood types in West Virginia have experienced considerable declines since 1949. While the hardwood types are expanding, softwood acreage dropped to less than 700,000 acres. The spruce-fir and Virginia pine-pitch pine types decreased about 44 percent between 1949 and 1975, despite a 16 percent increase in total commercial forest land acreage. Partially offsetting this loss was the white pine-red pine type, which grew to more than 100,000 acres by 1975, largely through planting. Softwood sawtimber volumes are greatest in the Virginia pine-pitch pine and the oak-pine types. The total softwood sawtimber volume in West Virginia was estimated at 2.6 billion board feet in 1975 [2].

COMMERCIAL FOREST INVENTORY

The 1974-75 inventory divided the state into three geographic sampling units, consolidating or eliminating some sampling units which had been used in previous surveys. These three divisions will serve as basic units for future surveys to permit comparisons at less than statewide levels (see Figure 2).

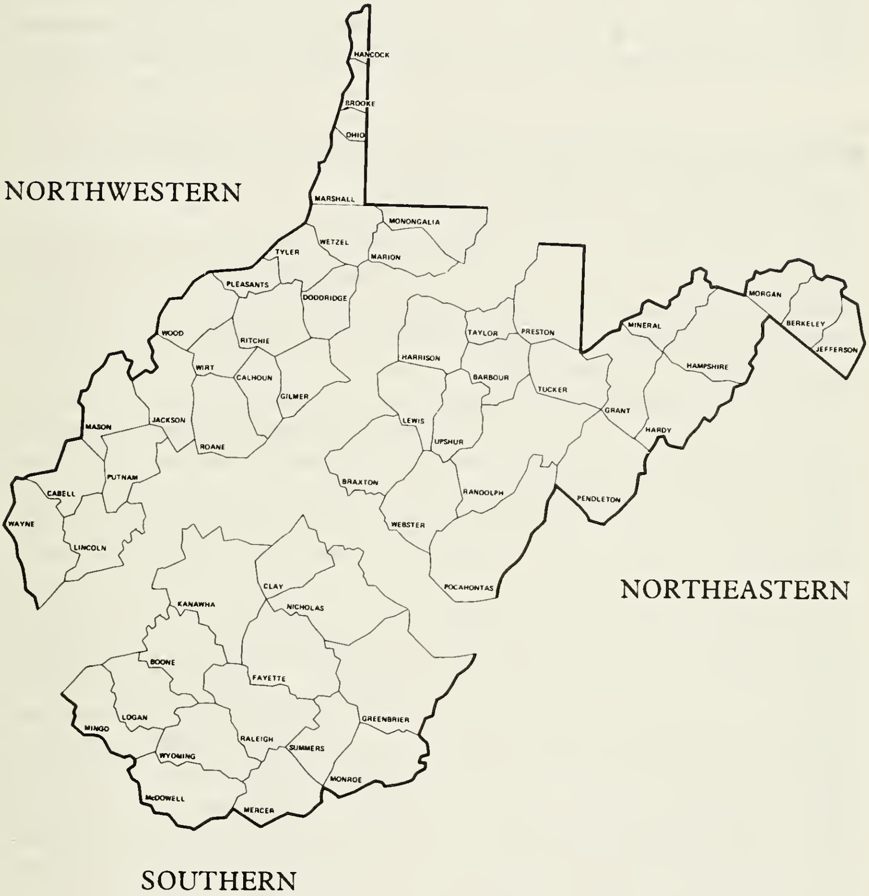
The northwestern unit encompasses 22 counties and 5.0 million acres. The northeastern unit consists of 19 counties and 5.9 million acres and the southern unit contains 14 counties and 4.5 million areas [2].

Complete forest inventory information from the 1975 survey is available in USDA Forest Service Resource Bulletin NE-56 [2], which includes more than 65 tables and figures of inventory data. There is no need to duplicate that information here. However, a look at sawtimber inventories by species, county, and geographic unit is appropriate (see Appendix B).

The northeastern unit, which includes most of the Monongahela National Forest and the Allegheny highlands, contains the greatest volume of sawtimber in the state—more than 10.7 billion board feet of sawtimber stand on 4.4 million acres of commercial forest land. The northeastern unit also includes three of the top four West Virginia counties in terms of sawtimber volume, Randolph, Pocahontas, Greenbrier, and Webster, respectively. Only Greenbrier County lies outside this unit. In addition, the northeastern unit boasts the greatest volume of select oaks in the state, as well as the largest volume of softwood sawtimber. The unit's 19 counties have 38.7 percent of the state's sawtimber volume, 51.8 percent of the softwood sawtimber volume, and 36.2 percent of the sawtimber volume in select oaks [2].

The southern unit, which encompasses 3.9 million acres of commercial forest land, contains 9.85 billion board feet of sawtimber. The greatest sawtimber volumes occur in Greenbrier and Kanawha counties, which have 1.5 billion board feet and 1.1 billion board feet, respectively. Forest industry holdings are heavily concentrated in the southern unit, where more than half of all the state's forest industry-owned land is located. In 1974 the southern unit was the leading producer of sawlogs in the state with a total sawlog harvest of 199.4 million

Figure 2. West Virginia forest survey geographic units, third forest survey, 1975.



Source: [2].

board feet, or 43 percent of the state's total harvest. In terms of supply, the southern unit contains about 35.6 percent of West Virginia's sawtimber volume [2].

In contrast with the landownership patterns in the northeastern and southern units, individuals and farmers own 79.7 percent of the 3.2 million acres contained in the northwestern unit, which has 7.1 billion board feet of sawtimber, with more than 1.6 billion feet (23.2 percent) in select oaks. However, the landownership patterns in the northwestern unit are not conducive to large-scale timber harvesting operations. Thus, the northwestern unit accounted for only 16.9 percent of the 1974 state sawlog harvest [2].

THE FUTURE TIMBER SUPPLY AND ITS POTENTIAL UTILIZATION

Since 1949 the commercial forest area in West Virginia increased 16 percent, to 11.5 million acres in 1975, with an accompanying 90 percent increase in growing stock volume [2]. Given present trends, these substantial growth results are expected to continue for the next 20 years and provide the state with a good outlook for timber supplies.

Projections of the 1975 timber inventory were made to the year 2005, based primarily on past trends (see Appendix Table A5). Almost a decade has passed since these predictions were made, thus allowing a limited amount of hindsight to be used when considering the accuracy of the projected values. To date, no major deviations have been noticed in the underlying assumptions used to project future inventory levels, so that the 1985 data, at least, appears fairly accurate.

By 1985 West Virginia should have a standing sawtimber inventory of 30.7 billion board feet and a total growing stock inventory of 16.9 billion cubic feet; increases of 11.5 percent and 25.1 percent respectively since 1975. By the year 2005 hardwood growing stock is expected to increase by 85 percent and softwood growing stock by 210 percent over 1975 volumes. The average volume of growing stock per acre also is expected to rise from 1,177 cubic feet in 1975 to nearly 2,000 cubic feet by 2005. In addition, annual growth per acre will increase from 41 cubic feet per acre to about 70 cubic feet per acre by 2005 [2].

The projected changes in West Virginia's timber supply yield some interesting social, economic, and silvicultural implications. Of major economic interest is the relatively low level of timber harvest in a state that is 80 percent forested. For more than a decade annual removals have been less than half of net annual growth. The economic and social results of these low harvests are obvious; West Virginia has failed to realize potential state and personal income resulting from jobs in the timber harvesting and wood products sector amounting to about half a billion dollars annually.[5]

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[5] 1981 estimated annual sales of West Virginia's wood products industry amounted to $484 million dollars. It is feasible for this sector to produce an output of about $970 million, roughly twice the 1981 output [11].

Less obvious are the silvicultural ramifications of low harvest levels. Many of the hardwood stands are presently overstocked with trees of poor quality or less-desired species. This results in annual growth per acre of readily usable wood well below the theoretical potential. Eighty-three percent of the commercial forest land in West Virginia is capable of producing more than 50 cubic feet per acre per year and 42 percent is theoretically capable of growing 85 cubic feet or more per acre per year. But average annual growth per acre in 1975 was only 41 cubic feet [2]. This represents a substantial loss of potential growth and quality. Timber harvest can be a major silvicultural tool used towards alleviating the overstocking and poor quality aspects of the current timber supply, especially when commercial thinnings are employed.

It is unrealistic, though, to assume that West Virginia's wood products industry will start harvesting substantially more timber from low-quality or overstocked stands, simply because it is there. The industry is presently structured to use mainly large, high-quality hardwoods. Large-scale utilization of small size, low-quality timber would require establishment of mills specifically designed to use such timber to make profitably marketable products. Such production technologies and markets do exist [11]. An active effort to attract such enterprises to the state would promise several benefits, such as new employment opportunities, larger incomes to timberland owners, growth in the state's economy, and a long-run improvement in the quality and utility of its timber inventory.

The attitudes and intentions of forest landowners regarding timber harvesting are also important determinants of the effective timber supply. A 1975 survey revealed that 69 percent of West Virginia's 207,500 private landowners had never harvested or sold timber from their lands; these owners controlled slightly more than 4 million acres (39 percent) of the state's 10.3 million acres of private forest land [1]. When asked about their plans for the future, only 8 percent of West Virginia's private woodland owners indicated that they planned to harvest timber within the next ten years; however, these owners controlled 36 percent of the state's private forest land (Table 3). Table 3 also shows that 39 percent of owners, controlling 41 percent of the private forest land, were indefinite regarding the intention to harvest timber. A startling 46 percent of all woodland owners said that they would never harvest, but these persons control only 19 percent of the private forest land.

The data seem to indicate severe restrictions on potential expansion of the state's timber harvest. Since private ownerships represent slightly more than 90 percent of West Virginia's commercial forest land [2], it is clear that most of the future timber harvest must come from that land. If the owners of only 36 percent of the state's private forest land have definite plans to harvest timber, a valid question arises whether present harvest levels can be sustained, let alone increased. Table 4 is designed to provide insight on this question. In 1975, the total inventory of timber on private land owned by persons who planned to harvest within the next ten years was more than four billion cubic feet of growing stock and more than eight billion board feet of sawtimber. In 1974, total removals of growing stock in the state were 166.1 million cubic feet, while removals of sawtimber were 433.1 million board feet[6] [2]. Thus, 1974 removals represented 4.1 percent of growing stock inventory and 5.3 percent of sawtimber inventory on these particular ownerships; it is apparent that, at 1974 rates of timber removal, the inventory of timber on these lands is quite adequate to sustain the state's timber industry for many years. (Removals for 1974 cited were from all timberlands in the state, including public ownerships. However, timber harvests from public ownerships in that year—and in the years since—were at very low levels.)

Table 3

Intentions of private forest landowners regarding future timber harvest, West Virginia, 1975

Intentions	Number	%	Acres owned*	%
will harvest in the next 1 to 10 years	16,100	8	3.67	36
indefinite about future harvest plans	80,700	39	4.27	41
will never harvest	95,600	46	1.99	19
no answer	15,100	7	0.40	4
Total	207,500	100	10.33	100

Source: [1].

*Millions of acres.

A somewhat different long-term prospect emerges, however, if removals are compared with growth rates. Table 4 shows that net annual growth on the lands of private owners with plans to harvest timber in the near future falls short of both growing stock and sawtimber removals for 1974. The shortfall in growing stock growth versus removals is small, but the shortfall in sawtimber growth is substantial—growth on sawtimber inventory on these owners' lands was only 60 percent of removals in 1974.

The lands owned by those who have definite interest in and future plans for timber harvesting must be considered the backbone of the state's timber supply. These are, on average, the larger forest landholdings in the state (see Table 4), and include the holdings of forest industry firms and most other corporate ownerships. These owners, along with the individual private owners of larger forest acreages, may be expected to maintain a continued interest in timber harvesting, in order to gain a return on their land investment.

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[6] Timber removals—see definition of terms.

Table 4
Average acreage owned, total inventory, and total growth on privately owned forest land, West Virginia, 1974–75

		Total inventory (1975) and growth (1974)*			
	Average	Growing stock**		Sawtimber†	
Owners who . . .	acres owned	Inventory	Growth	Inventory	Growth
will harvest in the next 10 years	228	4,026.0	151.2	8,140.1	263.1
are indefinite about future harvest plans	53	4,684.2	175.9	9,470.9	306.1
subtotal		8,710.2	327.1	17,611.0	569.1
will never harvest	21	2,183.0	82.0	4,413.8	142.7
no answer	26.5	438.8	16.5	887.2	28.7
Total		11,332.0	425.6	22,912.0	740.6

Source: Derived from [1] and [2].

*Based on statewide per-acre averages of: 1,097 cu. ft. inventory and 41.2 cu. ft. annual growth for growing stock; 2,218 bd. ft. inventory and 71.7 bd. ft. annual growth for sawtimber.

**Million cubic feet.

†Million board feet.

But the timber-based industry cannot indefinitely sustain present levels of harvest, much less grow, on the basis of timber supply from these ownerships alone. In the long run, a timber-based economy can thrive at harvest levels no greater than net growth rates. What about the prospects for future timber supply from the other two large groups of private woodland owners—those who are indefinite about future harvest plans and those who never intend to harvest? Owners who were indefinite about future timber harvest plans controlled 41 percent of West Virginia's privately owned forests in 1975 (Table 3). These ownerships are much smaller, on average, than those of owners who had definite short-term plans to harvest timber—53 acres versus 228 acres, respectively (Table 4). The reasons why these owners had no definite harvesting plans are not known. It is quite probable, though, that a large proportion of the acreage owned by these individuals will be harvested at some time, when stands grow to merchantable size, or when stumpage prices are particularly high, or when landowners face a financial crisis, etc. If all of this land is assumed to be available for harvest at some future time, the relevant inventory and growth rates (Table 4, subtotal row) indicate that the potential timber supply in West Virginia substantially exceeds current rates of utilization. Growing stock removals in 1974 were only 1.9 percent of the combined inventory of owners who definitely planned to harvest timber and owners who were indefinite; sawtimber removals were less than 2.5 percent of sawtimber inventory on these same lands. Combined growth on these ownerships was, in growing stock, 97 percent greater than removals in 1974, while combined sawtimber growth was more than 31 percent greater than removals.

The remaining private timberland—that owned by those who said they would never harvest—should also be considered.[7] This group controlled 19 percent of private woodland acreage in 1975 (Table 3), but their average tract size was quite small (Table 4). These lands cannot presently be considered part of the potential timber supply base, given owners' attitudes and the small average tract size. But even some of this land may be harvested at some future time, as owners' circumstances change, or as ownership changes.

PROJECTED TIMBER DEMAND-SUPPLY RELATIONSHIPS

Trends in population, economic activity, income, and wood products consumption indicate the likelihood of continued growth in the level of demand for timber in the next few decades. At the national level, demands on domestic hardwood forests are expected to increase by more than 100 percent by the year 2000 to six billion cubic feet. Meanwhile, hardwood supplies should be adequate until the turn of the century, but with increasing shortages thereafter. Because of this favorable demand-supply relationship for hardwoods, hardwood stumpage prices should not increase substantially until the year 2000 and beyond [5, 7].

It should be remembered, however, that these demand-supply relationships are not uniform for all species and timber sizes. For example, the outlook for fine hardwoods and larger-sized hardwood sawtimber is quite different from that for the smaller, low-quality material. Removals of preferred species such as white oak, hickory, hard maple, walnut, and black cherry have equaled or exceeded the net annual growth of these species for some time. Stumpage prices for these species have risen substantially with the increase in demand and are likely to experience continued large increases in the next few decades.

The demand for softwoods has exceeded available supplies for some time now and should continue to outpace any increases in softwood volumes. Large increases in relative prices of softwood and softwood products should reflect this greater demand. In West Virginia, however, softwoods comprise only 7 percent of the timber inventory and consequently they play only a minor role in the overall timber economy of the state.

In view of these demand-supply relationships, there appear to be substantial opportunities to increase the size and diversity of the timber-based economy in West Virginia. There is an immediate potential to perhaps double the size of the timber harvest in the state; the resulting income to woodland owners could, if reinvested in woodland management and improvement, increase annual growth per acre and timber quality.

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[7] The fourth group of owners—those who did not answer the survey—is not discussed here because they control a relatively minor portion of the forest land base.

SUMMARY

Few states can compare with West Virginia in terms of hardwood timber supplies. In 1977 West Virginia ranked eighth in the nation with 26 billion board feet of hardwood sawtimber in standing inventory. By 1985 that volume is expected to increase to more than 30 billion board feet. With annual growth almost twice annual removals, new forest-based industries can readily satisfy their raw material demands in West Virginia.

Because of high demand, however, economic shortages exist for some high-quality preferred species and large-diameter trees; but this situation is not limited to West Virginia. The relatively high percentage of low-quality, small-diameter timber in West Virginia is presently underutilized by the state's wood-using industry, but could be converted into marketable products via new and advanced wood processing technologies.

The sheer size, variety, and growth potential of West Virginia's timber resource is remarkable. In terms of resource supply, West Virginia has the potential to sustain a prosperous, growing timber-based industry as the twenty-first century approaches. The attainment of such potential, however, will require a conscious and coordinated effort from the state government, the forest industries, and the individual private forest landowners to provide a favorable business climate aimed at supporting a multi-dimensioned forest economy.

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APPENDIX A

Tables

A-1 Significant rankings of major timber components on commercial forest land in West Virginia, 1977

A-2 Volume of growing stock on West Virginia commercial forest land by diameter classes, 1949–1975

A-3 Annual net growth and timber removals, by species, West Virginia, 1975

A-4 Supply of fine hardwood sawtimber in West Virginia by species, section, region, and state, 1977

A-5 Projection of annual net growth, timber removals, and inventory of growing stock and sawtimber on commercial forest land in West Virginia, 1975–2005

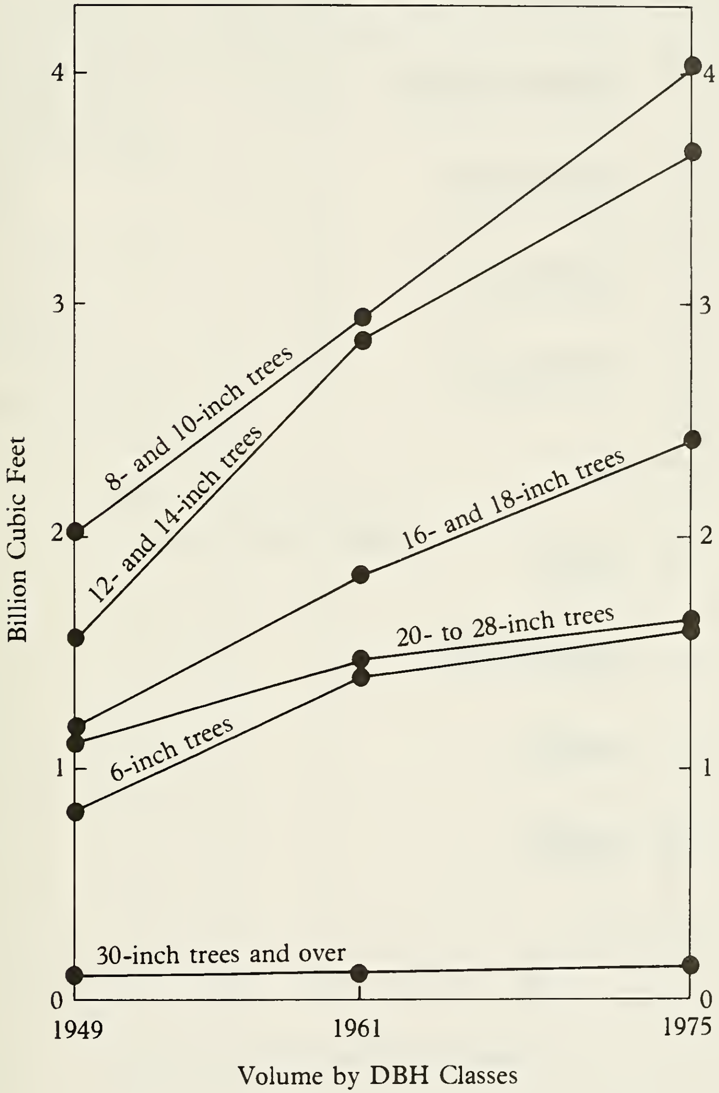
Table A-1
Significant rankings of major timber components on commercial forest land in West Virginia, 1977

Item	Standard Units	Number of Units	Rank in Northeast	Percent of Northeast	Rank in U.S.	Percent of U.S.
Total Land Area	Thousand Acres	15,404.8	4th	12.08	41st	0.7
Total Forest Land	Thousand Acres	11,668.6	4th	13.83	30th	1.6
Total Commercial Forest Land	Thousand Acres	11,483.7	4th	14.5	25th	2.4
Growing Stock Total Volume	Million Cubic Feet	14,152.7	3rd	14.16	20th	1.98
Growing Stock Softwood Volume	Million Cubic Feet	1,091.8	7th	3.47	33rd	0.24
Growing Stock Hardwood Volume	Million Cubic Feet	13,060.9	2nd	19.06	5th	5.1
Total Sawtimber Area	Thousand Acres	5,075.7	3rd	16.42	17th	2.4
Softwood Sawtimber Volume	Million Board Feet	2,901.1	7th	4.7	34th	0.2
Hardwood Sawtimber Volume	Million Board Feet	26,032.8	2nd	21.92	8th	4.4

Source: Adapted from *Forest Statistics of the United States.* 1977 [8].

Table A-2

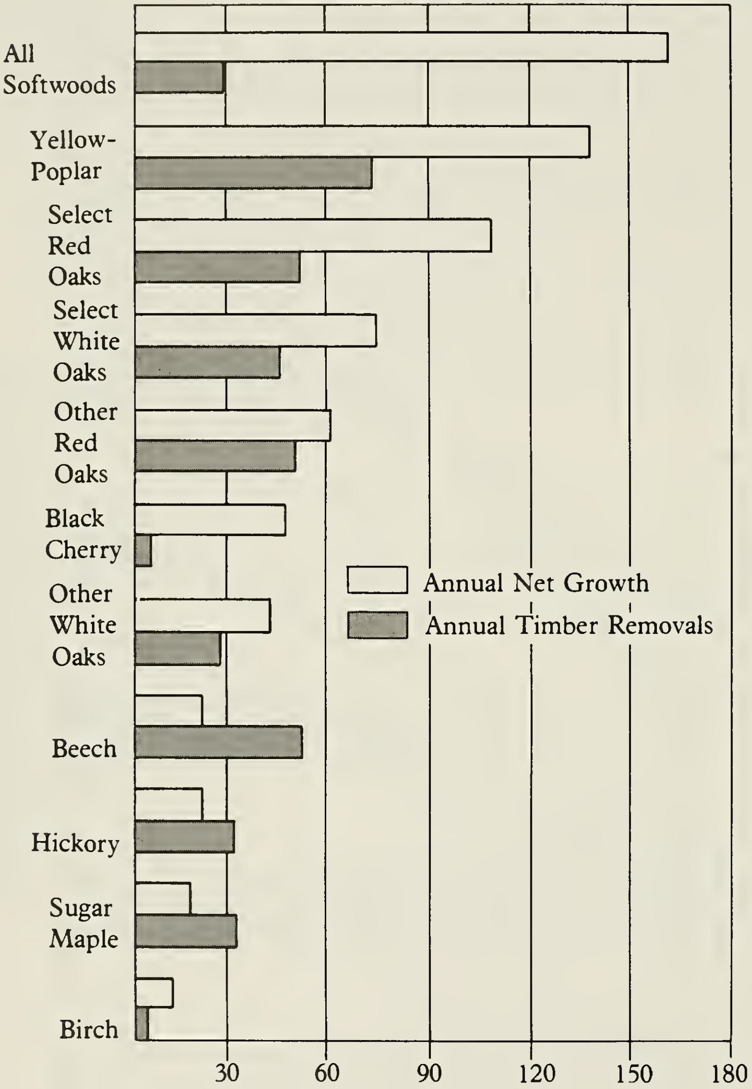
Volume of growing stock on West Virginia commercial forest land by diameter classes, 1949–1975



Source: [2].

Table A-3

Annual net growth and timber removals, by species, West Virginia, 1975



Million Cubic Feet of Growing Stock

Source: [2].

Table A-4

Supply of fine hardwood sawtimber in West Virginia by species, section, region, and state, 1977

Fine Hardwoods	State Volume MMBF	Percent of Northeast	Percent of East*	1974 Lumber Production MMBF
Total Hardwoods	26,032.8	21.9	4.94	293.9
Select Red Oaks	3,327.8	19.4	7.23	51.3
Select White Oaks	2,775.6	30.9	5.13	45.1
Other Red & White Oaks	6,365.0	35.6	5.36	74.3
Hickory	1,791.6	46.0	5.38	30.4
Hard Maple & Beech	2,721.5	12.3	5.94	84.0
Ash	615.1	13.6	3.45	8.8
Black Walnut	215.3	62.9	9.70	
Black Cherry	1,157.8	20.2	16.51	

Source: [3] and [8].

*East—See definition of terms.

Table A-5

Projection of annual net growth, timber removals, and inventory of growing stock and sawtimber on commercial forest land in West Virginia, 1975–2005[a]

Species group	1975 (inventory year)	1985	1995	2005
	Growing Stock *Million cubic feet*			
Softwoods:				
Removals	10.6	15.8	23.1	32.0
Growth	58.6	77.8	100.5	120.0
Inventory	995.0	1,541.9	2,249.2	3,087.3
Hardwoods:				
Removals	155.5	187.0	229.6	281.8
Growth	414.9	499.0	612.6	752.0
Inventory	12,520.4	15,370.1	18,868.4	23,162.9
Total:				
Removals	166.1	202.8	252.7	313.8
Growth	473.5	576.8	713.1	872.0
Inventory	13,515.4	16,912.0	21,117.6	26,250.2
	Sawtimber *Million board feet*[b]			
Softwoods:				
Removals	27.8	53.3	83.5	123.5
Growth	172.0	250.8	349.4	442.4
Inventory	2,599.7	4,390.0	6,826.6	9,921.6
Hardwoods:				
Removals	405.3	360.0	416.9	489.7
Growth	651.0	718.1	829.0	984.0
Inventory	25,031.1	26,392.0	30,193.6	34,764.0
Total:				
Removals	433.1	413.3	500.4	613.2
Growth	823.0	968.9	1,178.4	1,426.4
Inventory	27,630.8	30,782.0	37,020.2	44,685.6

Source: [2].

[a] Based upon the following assumptions: (1) total area of commercial forest land will increase approximately 300,000 acres in each decade; (2) growth rates based upon the average annual net growth between 1959 and 1974 will hold for the next 30 years; (3) there will be no major increase in the level of forest management or timber utilization during the next 30 years.

[b] International ¼-inch rule.

APPENDIX B

Tables

B-1 Net volume of sawtimber on commercial forest land in West Virginia, by forest type, county and geographic unit, 1975

B-2 Net volume of sawtimber on commercial forest land in West Virginia, by species, county and geographic unit, 1975

Table B-1

Net volume of sawtimber on commercial forest land in West Virginia, by forest type, county and geographic unit, 1975

(in millions of board feet)*

County	Virginia and pitch pine	Other softwood types	Oak-hickory	Maple-beech-birch	Other hardwood types	All types
Barbour	0.7	8.2	134.5	87.5	34.3	265.2
Berkeley	11.3	2.3	104.4	17.6	31.7	167.3
Braxton	1.4	21.8	284.3	186.9	66.2	560.6
Grant	35.4	3.6	232.7	56.1	73.9	401.7
Hampshire	29.4	5.8	329.0	41.0	102.7	507.9
Hardy	38.0	5.0	306.0	48.1	99.0	496.1
Harrison	.6	9.9	97.4	62.3	31.2	201.4
Jefferson	3.3	.5	21.1	3.8	7.0	35.7
Lewis	1.2	9.7	155.6	96.7	35.8	299.0
Mineral	26.3	2.4	149.7	28.1	53.8	260.3
Morgan	23.1	1.3	86.3	20.4	38.3	169.4
Pendleton	32.2	9.5	290.2	52.1	96.7	480.7
Pocahontas	2.6	256.8	438.0	949.9	109.5	1,756.8
Preston	1.9	18.6	324.3	209.1	72.1	626.0
Randolph	1.6	77.2	859.5	1,035.1	125.2	2,098.6
Taylor	.4	4.0	49.2	31.0	13.5	98.1
Tucker	.5	54.7	343.2	326.6	36.0	761.0
Upshur	.8	10.9	169.0	111.1	40.6	332.4
Webster	1.4	21.4	505.8	569.9	72.9	1,171.4
Northeastern Unit	212.1	523.6	4,880.2	3,933.3	1,140.4	10,689.6

(continued)

*International ¼-inch rule.

Table B-1 (continued)

Net volume of sawtimber on commercial forest land in West Virginia, by forest type, county and geographic unit, 1975

(in millions of board feet)*

County	Virginia and pitch pine	Other softwood types	Oak-hickory	Maple-beech-birch	Other hardwood types	All types
Boone	—	9.2	424.8	206.0	17.8	657.8
Clay	3.4	11.9	311.7	113.6	29.2	469.8
Fayette	6.3	14.2	550.5	199.9	52.0	822.9
Greenbrier	8.1	53.8	792.1	583.7	109.9	1,547.6
Kanawha	10.3	31.6	746.5	271.2	71.6	1,131.2
Logan	—	11.4	390.2	150.8	21.9	574.3
McDowell	—	14.6	378.9	175.5	34.4	603.4
Mercer	2.8	9.4	332.2	122.5	32.8	499.7
Mingo	—	10.1	343.3	150.2	22.9	526.5
Monroe	11.1	13.5	237.7	83.0	21.6	366.9
Nicholas	7.3	11.7	506.4	306.8	43.5	875.7
Raleigh	5.4	9.2	492.3	177.9	47.3	732.1
Summers	3.3	10.4	271.4	98.7	26.9	410.7
Wyoming	9.1	48.4	391.4	143.9	36.7	629.5
Southern Unit	67.1	259.4	6,169.4	2,783.7	568.5	9,848.1
Brooke	1.8	—	30.0	9.4	6.1	47.3
Cabell	25.4	—	150.0	48.8	34.3	258.5
Calhoun	32.3	—	138.8	49.4	36.0	256.5
Doddridge	5.6	—	268.7	75.6	39.0	388.9
Gilmer	6.3	—	266.8	72.2	43.6	388.9
Hancock	1.9	—	30.2	12.2	6.4	50.7
Jackson	45.8	—	230.0	75.5	51.9	403.2
Lincoln	11.4	—	356.0	124.4	71.1	562.9
Marion	5.7	—	228.0	63.2	31.0	327.9
Marshall	7.2	—	129.4	50.0	28.1	214.7
Mason	62.6	—	175.6	55.7	43.6	337.5
Monongalia	6.5	—	260.9	73.0	40.0	380.4
Ohio	2.5	—	47.0	16.7	9.8	76.0
Pleasants	9.0	—	144.5	37.3	22.1	212.9
Putnam	58.0	—	203.4	62.8	46.2	370.4
Ritchie	27.0	—	350.2	98.7	66.1	542.0
Roane	39.7	—	216.8	83.7	52.3	392.5
Tyler	13.7	—	174.1	52.1	32.6	272.5
Wayne	36.1	—	304.8	104.7	70.6	516.2
Wetzel	7.7	—	274.3	85.3	53.2	420.5
Wirt	60.0	—	164.4	52.7	41.4	318.5
Wood	64.4	—	186.0	60.1	43.7	354.2
Northwestern Unit	530.6	—	4,329.9	1,363.5	869.1	7.093.1
Total, State	809.8	783.0	15,379.5	8,080.5	2,578.0	27,630.8

Source: [2].

Table B-2

Net volume of sawtimber on commercial forest land in West Virginia, by species, county and geographic unit, 1975

(in millions of board feet)*

County	Softwoods	Select oaks	Other hard hardwoods	Yellow-poplar	Other soft hardwoods	Total all species
Barbour	16.0	50.1	109.7	43.9	45.5	265.2
Berkeley	27.8	46.8	71.0	4.2	17.5	167.3
Braxton	36.0	108.6	231.5	89.2	95.3	560.6
Grant	79.2	105.2	154.4	7.4	55.5	401.7
Hampshire	82.5	147.4	213.5	12.8	51.7	507.9
Hardy	85.9	140.1	203.1	11.8	55.2	496.1
Harrison	16.8	35.5	79.7	33.8	35.6	201.4
Jefferson	6.4	10.1	14.3	0.8	4.1	35.7
Lewis	21.1	54.4	120.3	53.3	49.9	299.0
Mineral	50.3	71.8	101.3	5.3	31.6	260.3
Morgan	37.9	44.9	61.4	2.6	22.6	169.4
Pendleton	84.3	132.9	192.8	11.8	58.9	480.7
Pocahontas	259.3	285.1	704.6	97.2	410.6	1,756.8
Preston	40.6	117.5	256.2	104.0	107.7	626.0
Randolph	237.4	369.7	806.8	232.3	452.4	2,098.6
Taylor	7.6	17.5	38.9	17.1	17.0	98.1
Tucker	104.8	122.0	247.2	119.8	167.2	761.0
Upshur	19.4	64.3	138.3	53.5	56.9	332.4
Webster	132.8	201.2	407.1	184.6	245.7	1,171.4
Northeastern Unit	1,346.1	2,125.1	4,152.1	1,085.4	1,980.9	10,689.6
Boone	9.8	112.1	372.2	118.7	45.0	657.8
Clay	26.8	109.1	220.4	72.4	41.1	469.8
Fayette	41.8	193.2	390.1	126.6	71.2	822.9
Greenbrier	147.6	324.3	682.5	169.3	223.9	1,547.6
Kanawha	66.2	267.0	526.8	172.9	98.3	1,131.2
Logan	9.4	91.2	325.2	104.2	44.3	574.3
McDowell	11.8	108.4	329.9	119.7	33.6	603.4
Mercer	25.2	120.2	236.3	75.4	42.6	499.7
Mingo	9.0	88.0	297.4	97.6	34.5	526.5
Monroe	25.2	86.2	163.3	58.9	33.3	366.9
Nicholas	47.4	190.8	384.7	148.9	103.9	875.7
Raleigh	34.3	175.5	347.8	111.8	62.7	732.1
Summers	22.7	98.3	193.0	61.8	34.9	410.7
Wyoming	60.1	139.3	277.4	95.9	56.8	629.5
Southern Unit	537.3	2,103.6	4,747.0	1,534.1	926.1	9,848.1

(continued)

*International ¼-inch rule.

Table B-2 (continued)

Net volume of sawtimber on commercial forest land in West Virginia, by species, county and geographic unit, 1975

(in millions of board feet)*

County	Softwoods	Select oaks	Other hard hardwoods	Yellow-poplar	Other soft hardwoods	Total all species
Brooke	3.0	11.3	23.0	4.6	5.4	47.3
Cabell	31.9	57.4	116.4	26.1	26.7	258.5
Calhoun	40.3	53.7	111.5	26.5	24.5	256.5
Doddridge	15.6	98.7	205.9	33.0	35.7	388.9
Gilmer	17.2	98.9	200.4	34.4	38.0	388.9
Hancock	3.4	11.5	24.6	4.8	6.4	50.7
Jackson	54.9	88.8	180.6	36.8	42.1	403.2
Lincoln	32.1	135.5	276.7	53.6	65.0	562.9
Marion	12.9	82.9	175.4	28.1	28.6	327.9
Marshall	14.5	49.3	103.1	21.6	26.2	214.7
Mason	66.7	67.9	141.2	31.6	30.1	337.5
Monongalia	16.2	96.2	199.0	32.2	36.8	380.4
Ohio	4.9	17.9	36.8	7.3	9.1	76.0
Pleasants	14.1	53.7	109.6	16.4	19.1	212.9
Putnam	64.1	78.8	160.7	32.1	34.7	370.4
Ritchie	42.4	132.5	264.8	46.8	55.5	542.0
Roane	50.6	83.9	175.2	39.8	43.0	392.5
Tyler	21.1	65.4	133.7	25.1	27.2	272.5
Wayne	53.2	117.0	236.8	53.0	56.2	516.2
Wetzel	22.4	103.9	208.3	38.6	47.3	420.5
Wirt	66.3	65.6	132.0	24.7	29.9	318.5
Wood	68.5	72.4	149.9	31.1	32.2	354.2
Northwestern Unit	716.3	1,643.2	3,365.6	648.2	719.8	7,093.1
Total, State	2,599.7	5,871.9	12,264.7	3,267.7	3,626.8	27,630.8

Source: [2].

APPENDIX C

Definition of Terms

Basal Area—The area, in square feet, of the cross-section at breast height of a single tree or of all the trees in a stand, usually expressed as square feet of basal area per acre [8].

Board Foot—A unit of lumber 1 foot long, 1 foot wide, and 1 inch thick, or its equivalent [2].

Cull Trees—Live trees of sawtimber and poletimber size that are unmerchantable for sawlogs now or prospectively because of roughness, rot, or species [8]. Average annual cull increment is the net volume of trees that become rough or rotten trees during the period between surveys, divided by the number of years between surveys [2].

Diameter Class—A classification of trees based on the diameter outside bark measured at breast height. When using 2-inch diameter classes, the 6-inch class, for example, includes trees 5.0 through 6.9 inches dbh inclusive [8].

East—Includes those states in the following regions: New England, Mid-Atlantic, Lake States, Central States, South Atlantic, East Gulf, Central Gulf, West Gulf.

Eastern Forest Ecosystem—This broad ecosystem extends from the eastern seaboard to the great plains, and consists of the following forest types: white-red-jack pine; spruce-fir; longleaf-slash pine; loblolly-shortleaf pine; oak-pine; oak-gum-cypress; elm-ash-cottonwood; maple-beech-birch; and aspen-birch [8].

Fine Hardwoods—Those trees of hardwood species which exhibit a high grade of quality and are preferred by veneer and furniture manufacturers. Principal species included in this group are oak, hickory, maple, birch, beech, walnut, and black cherry.

Growing Stock Volume—Net volume in cubic feet of live sawtimber and poletimber trees from stump to a minimum 4-inch top (of central stem) outside bark, or to the point where the central stem breaks into limbs [8].

Ingrowth—The number or net volume of trees that grow large enough during a specified year to qualify as saplings, poletimber, or sawtimber [8]. Average annual ingrowth is the net volume of trees now included in the class that were not tallied as such on the initial survey, divided by the number of years between surveys [2].

Log Grade—A classification of logs based on external characteristics as indicators of quality and value [8].

Mortality—The number or volume of sound wood in live trees dying from natural causes during a specified period [8]. Average annual mortality is the net volume removed from a class because of mortality during the period between surveys, divided by the number of years between surveys [2].

Net Annual Growth—The annual change in volume of sound wood in live sawtimber and poletimber trees resulting from natural causes [8].

Northeast—Includes Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, Delaware, Maryland, New Jersey, New York, Pennsylvania, West Virginia.

Overstocked Areas—Areas where growth of trees is significantly reduced by excessive numbers of trees [8].

Quality Class—A classification of sawtimber volumes by log or tree grades [8].

Sawtimber Volume—Net volume of the saw log portion of live sawtimber trees in board feet (International ¼-inch log rule) [8]. Net volume equals gross volume less deductions for rot, sweep, and other defects that affect use for lumber [2].

Site Class—A classification of forest land in terms of inherent capacity to grow crops of industrial wood [2].

Stocking—The degree of occupancy of land by trees, measured in terms of basal area of trees in a stand compared to the minimum basal area of trees required to utilize fully the growth potential of the land. The actual stocking at a point is evaluated against a standard of 75 square feet of basal area per acre. The degree of plot stocking is viewed as a percent of the basal area standard.
Fully stocked = 100–133 percent.
Overstocked = greater than 133 percent.
Medium stocked = 60–100 percent.
Poorly stocked = 16.7–60 percent.
Non-stocked = less than 16.7 percent [2].

Timber Removals—The net volume of growing stock trees removed from the inventory by harvesting, cultural operations, such as timberstand inprovement, land clearing, or changes in land use [8].

FORESTS & THE WEST VIRGINIA ECONOMY

Volume 3: The Commercial Timber Harvest in West Virginia

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Authors

Kenneth D. Jones is research technologist and Gary W. Zinn is associate forest scientist in the Division of Forestry, West Virginia Agricultural and Forestry Experiment Station, West Virginia University.

West Virginia University
Agricultural and Forestry Experiment Station
College of Agriculture and Forestry
Robert H. Maxwell, Director
Morgantown

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FOREWORD

This is the third in a series of reports on West Virginia's forest resources. The series examines the forest resources, their current levels of utilization, their present role in the state's economy, the outlook for the future, and the prospects for increasing the economic contribution of forests and forest-based activity for the benefit of the citizens of West Virginia.

These reports focus mainly on timber resources and the timber-based economy. Observations are included on other forest resources and their uses including outdoor recreation, fish and wildlife, water, and wilderness; but these will not be covered in depth. Detailed research on the state's nontimber resources and their use is in progress and will be reported separately.

The research reported here was conducted under the auspices of the West Virginia Agricultural and Forestry Experiment Station at West Virginia University. Major financial support was provided by the West Virginia Governor's Office of Community and Industrial Development and by the Experiment Station. Other principal cooperators include the West Virginia Department of Natural Resources, the USDA Forest Service, and the West Virginia Forestry Association. The investigators gratefully acknowledge the support and cooperation of these agencies and organizations.

HIGHLIGHTS

1. In 1979, West Virginia's timber producers harvested 89.27 million cubic feet of roundwood from the state's forests. Ninety-two percent of this (81.8 million ft^3) was hardwoods and 8 percent (7.4 million ft^3) was softwoods.
2. Of the state's total harvest, approximately 73 percent (65.1 million ft^3) was processed as sawlogs and 12 percent (10.7 million ft^3) was utilized as pulpwood. The production of mine timbers and fencing accounted for an additional 13 percent (11.7 million ft^3).
3. The 1979 timber harvest in West Virginia was down 16 percent from 1974 harvest levels. Furthermore, the 1979 timber harvest represented a decline in harvest activity of 32 percent since 1965. From 1965–79, hardwood removals decreased 31 percent, while softwood harvests declined 44 percent.
4. In 1979, the sawlog harvest from West Virginia timberlands was 417.3 million board feet—down 9.8 percent from 1974. Ninety-six percent of all sawlogs came from hardwoods, with red oaks accounting for 35 percent of all sawlog volume. West Virginia was also a net exporter of sawlogs in 1979, shipping 53.5 million board feet of sawtimber to other states.
5. In 1982, West Virginia's total pulpwood production amounted to a record volume of 457,600 standard cords (38.89 million ft^3). In 1983, total pulpwood production from all sources in West Virginia declined 15 percent to 389,400 cords. Pulpwood production from roundwood amounted to 246,600 standard cords, while chip production from manufacturing residues contributed 142,800 standard-cord equivalents. All of West Virginia's pulpwood production was exported to other states.
6. The veneer log harvest attained a record level of 8.5 million board feet in 1979. The 1980 harvest was down slightly to 7.5 million board feet, but veneer receipts increased to 23.4 million board feet, setting a record for the second consecutive year.
7. In 1979, mine timber production rose 13 percent over 1974 levels to 7.6 million ft^3.
8. Rustic fence production in West Virginia has grown by more than four times since 1965—producing more than 3 million pieces in 1979.
9. The state's Christmas tree growers harvested 115,873 trees in 1984, generating $1,733,000 in sales.
10. West Virginia's total fuelwood consumption in 1981 was estimated at 874,000 cords—over twice as much as the state's total 1983 pulpwood production.

11. The timber harvest ranked as the state's third largest cash crop in 1979 with an estimated stumpage value of $39,688,000. Sawmills and other buyers of sawlog stumpage paid an estimated $30.9 million to forest land owners—78 percent of timber harvest's total estimated value. The sale of timber for veneer logs and mine timbers also brought woodland owners considerable revenue but represented a much smaller percentage of the timber harvest's total value.

FORESTS AND THE WEST VIRGINIA ECONOMY

3. The Commercial Timber Harvest in West Virginia

Kenneth D. Jones and Gary W. Zinn

INTRODUCTION

It may be that civilization would not have occurred if primitive man had not had an abundant, readily available supply of wood, for almost all of man's early needs were met by this versatile material. From fuel for fire to structural materials for shipbuilding and home construction, wood has been one of the most utilized natural resources of all time.

In West Virginia, as in much of the world, there was no shortage of trees prior to the arrival of modern man. Trees covered the entire landscape except for a few natural openings or where Indians had cleared a small patch of land for agriculture. Trees were often a nuisance to the early settlers who would cut and burn large areas of virgin forest to clear land for farms or buildings.

The first sawmill west of the Allegheny mountains was operataed by John Minear in 1776 near the town of St. George in Tucker County [4]. This water-powered mill employed a device known as a sash saw, which allowed two men to cut up to 500 linear feet of lumber a day, not much wood by modern standards, but it marked the beginning of lumber production in West Virginia.

Timber production peaked in West Virginia in 1909 when nearly 1.5 billion board feet of lumber was cut [4]. With the virgin forests now gone, it is doubtful that production will ever again reach such a high level. For the past 35 years timber production in West Virginia has averaged only about 400 million board feet annually, barely rivaling the volumes sawed in the early 1890s.

This volume of the West Virginia Forest Development Series examines the latest timber production information available for the state of West Virginia. It defines the status of timber production in the state and provides insight into the dynamics of West Virginia's timber-based industry.

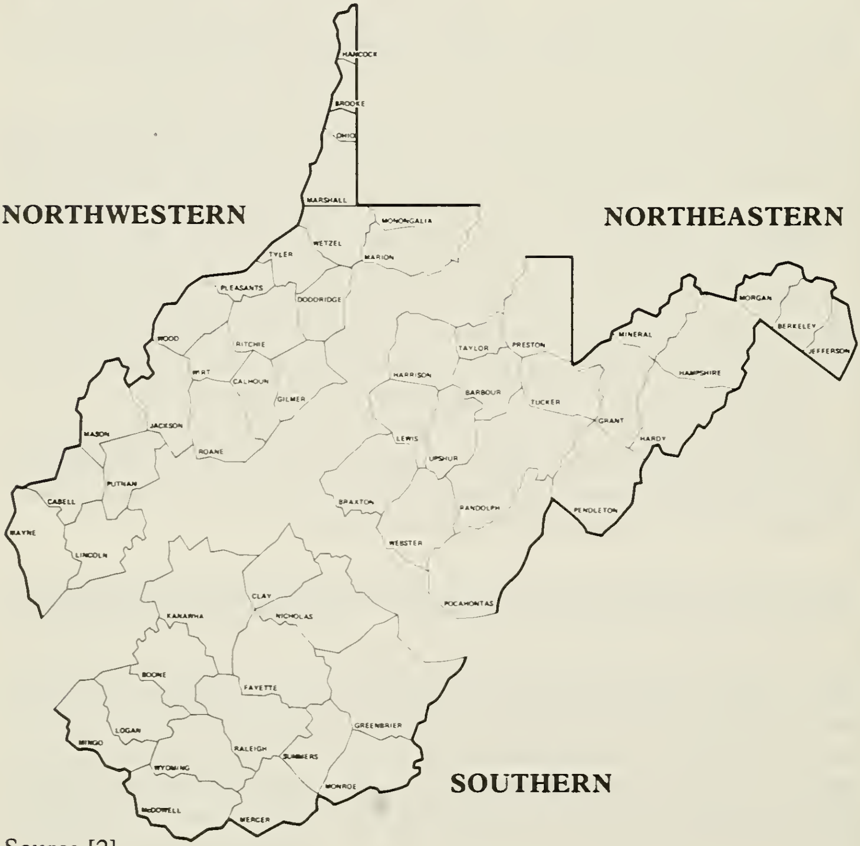
HIGHLIGHTS OF THE 1979 TIMBER HARVEST

In 1979, the latest year for which complete harvest information is available, West Virginia's timber producers harvested about 89.27 million cubic feet of roundwood from the state's forests. About 92 percent (81.8 million ft^3) of the harvested timber was hardwoods and 8 percent (7.4 million ft^3) was softwoods. Seventy-three percent of the total harvest statewide was processed as sawlogs which were then manufactured into lumber. Approximately 10.72 million cubic feet of roundwood, or 12 percent of the state's timber harvest, was cut for pulpwood and exported to paper mills in neighboring states; 11.69 million cubic feet, or 13 percent of the roundwood harvest, went into the production of mine timbers and fencing. The remaining portion of the harvest was used in the veneer and cooperage industries or was manufactured into cabin logs, dimension bolts, handle stock, wedges, and other miscellaneous wood products [11]. (See Table 1 and Appendix Table A1.)

Most of the 1979 timber harvest came from the northeastern and southern geographic units of the state (Figure 1). The northeastern unit accounted for 46 percent of the state's total harvest, 45 percent of all sawlog production, and 56 percent of the state's pulpwood harvest.

The southern unit produced 39 percent of the total harvest, including 40 percent of the sawlog harvest and 34 percent of the state's pulpwood. The northwestern unit had a relatively low timber output—only 15 percent of the 1979 timber harvest and sawlog harvest and only 10 percent of the state's pulpwood production [11]. (See Appendix Table A2.)

Figure 1. West Virginia forest survey geographic units, 1975.



Source [2].

Table 1

The timber harvest in West Virginia, by product, 1979

Product	Volume*	Percent
Sawlogs	65.1	73
Pulpwood	10.7	12
Veneer Logs	1.3	1
Mine Timbers	7.6	8
Fencing	4.1	5
Misc. Products**	.5	1
Total	89.3	100

Source: [11].

*Million cubic feet.

**Miscellaneous products include cooperage, cabin logs, dimension bolts, handle stock, poles, and wedges.

RECENT TRENDS IN WEST VIRGINIA'S TIMBER HARVEST

Prior to 1979, two surveys of the timber industry had been conducted in West Virginia, in 1965 and in 1974. The latest survey was conducted in 1979 by the U.S. Forest Service and the West Virginia Department of Natural Resources.[1] Although the years in which the surveys took place may not be representative of the long-term production trends in West Virginia's timber industries, they do provide some comparative data over a 14-year period.

In addition to the comprehensive statewide survey of the timber industry which occurs about every ten years, the U.S. Forest Service also conducts periodic surveys on special segments of the wood industry. In the northeastern region of the United States, which includes West Virginia, pulpwood production is surveyed annually and the veneer industry is canvassed about every four years. Updated information is available on these industries as late as 1982 and 1980 respectively. With the addition of these supplementary surveys, trends in these industries can be more easily distinguished.

From 1974 to 1979, the total industrial roundwood harvest in West Virginia dropped 17.5 million cubic feet, a 16 percent drop in the state's total timber output. Furthermore, the timber harvest in West Virginia decreased 32 percent between 1965 and 1979, despite a 16 percent increase in the state's timber supplies during the same period.

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[1] All 1979 harvest volumes and statistics were reported in Nevel, Robert L., Jr., and Edward Murriner, 1981. *West Virginia Timber Industries—A Periodic Assessment of Timber Output.* Unpublished File Report, USDA Forest Service, Northeast Forest Experiment Station, Forest Inventory and Analysis Unit, Broomall, Pa. Special acknowledgment is hereby given to the authors. Reference is to Nevel & Murriner unless otherwise noted.

The declines in harvest volumes occurred in both the hardwood and softwood timber types. From 1965 to 1979, hardwood removals decreased 31 percent, while softwood harvests declined 44 percent (Table 2).

The drop in roundwood harvests in West Virginia is reflected in production levels of the state's two major timber products—sawlogs and pulpwood. In 1979, sawlog production was down 9.8 percent from the 1974 harvest and since 1965 it has dropped a total of 23 percent. Similarly, the 1979 pulpwood harvest was 41 percent lower than 1974 levels and 60 percent less than the 1965 harvest (Table 3).

Annual assessments of pulpwood production after 1979 indicate that the downward trend has reversed. A 150 percent increase occurred in 1980; and by 1982 pulpwood production had risen to an all-time high of 457 thousand standard cords[2] [16].

In addition to the declines in the sawlog and pulpwood harvests during the late 1970s, the volume of timber cut for miscellaneous products such as cooperage, cabin logs, handles, wedges, and dimension bolts also declined substantially in 1979. More timber was cut in 1979 as compared to 1974 for only three minor products—veneer logs, mine timbers, and fencing. The harvest of veneer logs increased nearly 300 percent over 1974 volumes, while 13 percent more timber was cut for use as mine timbers. The production of fence materials increased about 42 percent over the same period.

The declining timber harvests in West Virginia have not been limited to any one geographic unit. All three geographic units in the state registered declines in timber removals in 1979 (Table 4).

Table 2

Harvest volumes from West Virginia by timber type
for selected years, 1965, 1974, 1979

	1965	1974	1979	% Change '65–74	% Change '74–79	% Change '65–79
	(million cubic feet)					
Hardwoods	118.8	95.0	81.8	-20.0	-13.8	-31.1
Softwoods	13.2	11.6	7.4	-12.1	-36.2	-43.9
All Species	132.0	106.6	89.2	-19.2	-16.3	-32.4

Source: [11].

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[2] Standard cord—see definition of terms.

Table 3

Trends in sawlog and pulpwood production in West Virginia, 1965–1979

	1965	1974	1979	% Change '65–74	% Change '74–79	% Change '65–79
	(million cubic feet)					
Sawlogs	84.5	72.2	65.1	-14.5	-9.8	-22.9
Pulpwood	27.1	18.2	10.7	-32.8	-41.2	-60.5
Total Harvest	132.0	106.6	89.2	-19.2	-16.4	-32.5

Source: [11].

Table 4

Timber harvest in West Virginia by geographic unit, 1974 and 1979

Geographic Unit	1974	1979	% Change
	(million cubic feet)		
Northestern	47.1	40.9	-13
Southern	41.7	35.2	-16
Northwestern	17.8	13.1	-26
Totals	106.6	89.2	-16

Source: [11].

THE SAWLOG HARVEST IN WEST VIRGINIA, 1979

The sawlog harvest from West Virginia timberlands in 1979 was 417.3 million board feet (MMBF). Hardwoods made up 399.3 MMBF (96 percent) of the harvest, while softwoods accounted for only 4 percent. The 1979 sawlog harvest was 9.8 percent less than the 1974 harvest and 22.9 percent less than in 1965.

Oaks were the predominant species cut for sawlogs in 1979, comprising 56 percent of the hardwood sawlogs and 54 percent of the total roundwood removals that year. Red oaks accounted for 35 percent of all sawlog volume and white oaks for 19 percent. Yellow-poplar accounted for 16 percent of all sawlog volume in 1979. Other important species removed for sawlogs that year were hickory, sugar maple, red maple, and black cherry. Hemlock and white pine were the most important softwoods harvested. (See Appendix Table A3 and Figure 2.)

In 1979, the northeastern unit led the state in sawlog production with 187.6 million board feet. This was in contrast to the 1965 and 1974 surveys which showed that the southern unit had been the state's leading sawlog producer. In 1979, the southern unit harvested only 168.7 MMBF of sawlogs, about 11 percent less than the northeast's output. The southern unit's loss of status was a reflection of a 26 percent drop in its sawlog output since 1965.

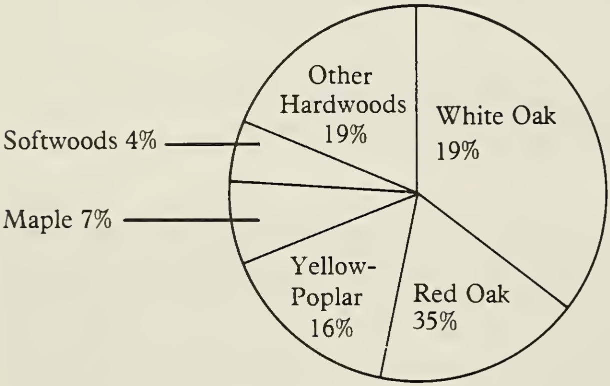
Percentage-wise, the northwestern unit's sawlog harvest was no better than the southern unit's output—dropping 22 percent from 1974 levels and falling below its 1965 harvest level. In 1979, the northwestern unit produced only 61 million board feet of sawlogs.

When combined, the northeastern and the southern units accounted for 85 percent of the 1979 sawlog harvest and helped to minimize the effect of declining sawlog production in the northwestern unit. The substantial decrease in the southern unit's sawlog output accounted for most of the drop in the state's sawlog harvest in recent years.

West Virginia was a net exporter of sawlogs in 1979, shipping 53.5 million board feet of sawtimber to other states. More than 50 percent of the exported logs went to Pennsylvania and 25 percent to Virginia, with Maryland and Ohio the other major importers.

West Virginia imported 5.2 million board feet of sawlogs in 1979—mostly oaks and yellow-poplar from Virginia and Pennsylvania. After deducting

Figure 2. Sawlog production by species in percent, West Virginia, 1979.



Source: [11].

imports, the adjusted balance of sawlog exports totaled 48.3 million board feet, giving West Virginia net sawlog receipts[3] amounting to 369 million board feet in 1979. (See Appendix Tables A3 and A4.) Net sawlog receipts in 1979 were down 18 percent from 1974.

THE PULPWOOD HARVEST

Although no pulp mills have operated in West Virginia since the 1930s, large mills in neighboring states rely heavily on West Virginia pulpwood in their manufacturing processes. Thus the production of pulpwood remains an important aspect of the state's timber industry. In 1979, pulpwood production made up 12 percent of the state's timber harvest. All of the state's production is exported.

Most of West Virginia's pulpwood is shipped to Westvaco Corporation's pulp and paper mills at Luke, Maryland and Covington, Virginia. Much of the remaining pulpwood goes to mills in Ohio, Pennsylvania, and elsewhere in Virginia. At Westvaco's Luke mill, pulpwood is chipped at the firm's log yard in Piedmont, West Virginia, and blown through a large tube across the Potomac River to the pulp mill in Maryland. With major paper operations located so close to its borders, West Virginia has been, for quite some time, the leading exporter of pulpwood in the northeastern United States.[4]

Pulpwood comes from two sources: (1) harvesting roundwood, and (2) woodchips made from manufacturing residue. In 1982, West Virginia's total pulpwood production amounted to a record volume of 457,600 standard cords (38.89 million cubic feet). Of that total, 271.5 thousand cords came from roundwood harvests, accounting for 59 percent of total pulpwood production. The production of chipped manufacturing residues, meanwhile, reached a near record level of 186.1 thousand cord equivalents and contributed 41 percent of the state's total pulpwood production in 1982 (Figure 3) [16].

In 1983, total pulpwood production from all sources in West Virginia declined 15 percent to 389,400 cords. Pulpwood production from roundwood amounted to 246,600 standard cords, while chip production from manufacturing residues contributed 142,800 standard-cord equivalents.

Little change has occurred in the pulpwood species mix over the last 15 years. Hardwoods were still the major source of pulpwood in 1982, accounting for 88 percent of total pulpwood production. Oaks and hickories were the major hardwood species harvested for pulpwood in 1982 and accounted for 52 percent of the round pulpwood harvest. In addition, 98 percent of the chipped manufacturing residues were also hardwoods. Softwoods comprised 12 percent of the pulpwood production in 1982, with pine accounting for almost all of the softwood harvested for pulp. Some hemlock was also harvested, but was of little significance (Figure 4) [16].

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[3] Receipts—see definition of terms.

[4] Northeastern U.S.—see definition of terms.

Figure 3. Pulpwood production in West Virginia by source, 1965–1983.

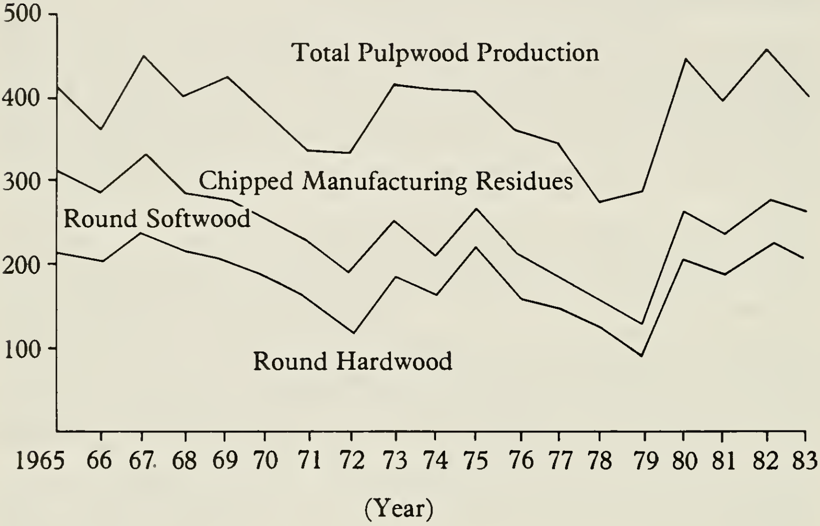
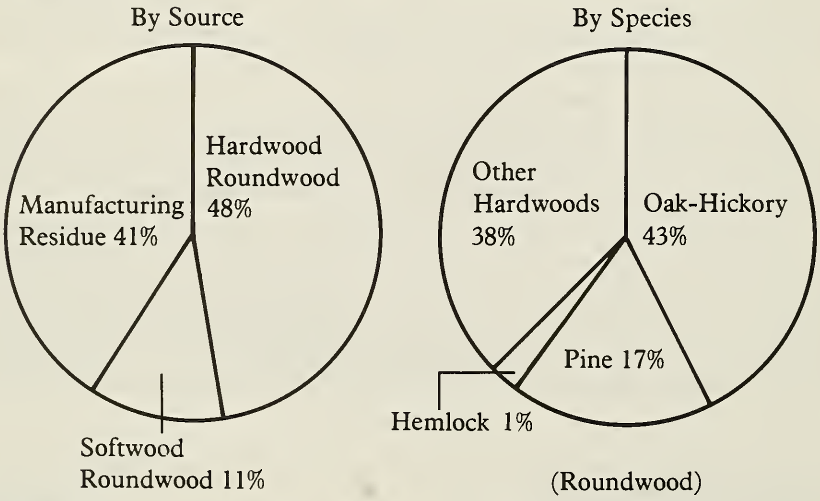


Figure 4. West Virginia pulpwood production by source and species, 1982.

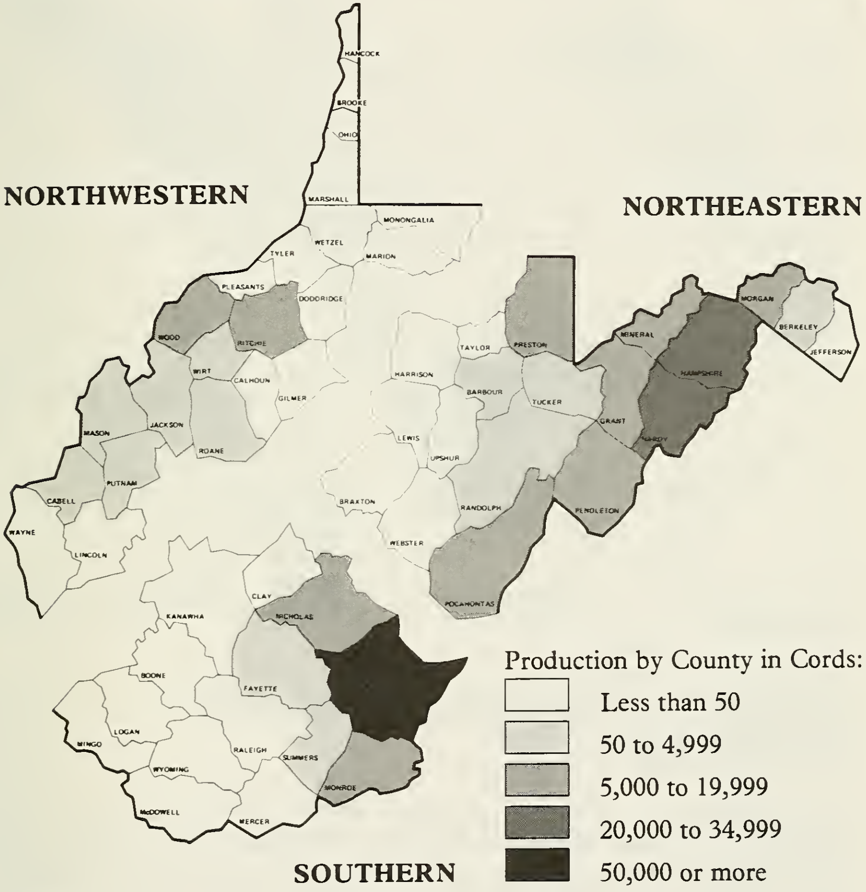


Source: [11].

Greenbrier County, with 97.1 thousand cords of pulpwood harvested in 1982, has led the state in pulpwood production since the mid-1970s. Other major pulpwood-producing counties in 1982 were Hampshire and Hardy, where 30.2 thousand cords and 21.2 thousand cords were harvested, respectively [16]. (See Figure 5.)

In 1981, Greenbrier County also had the highest cubic-foot pulpwood harvest per acre of commercial forest land. Grant, Morgan, and Wood counties also had a high degree of pulpwood harvest intensity[5] [18].

Figure 5. Geographic pattern of pulpwood production from roundwood, by county, West Virginia, 1981.



Source: [11].

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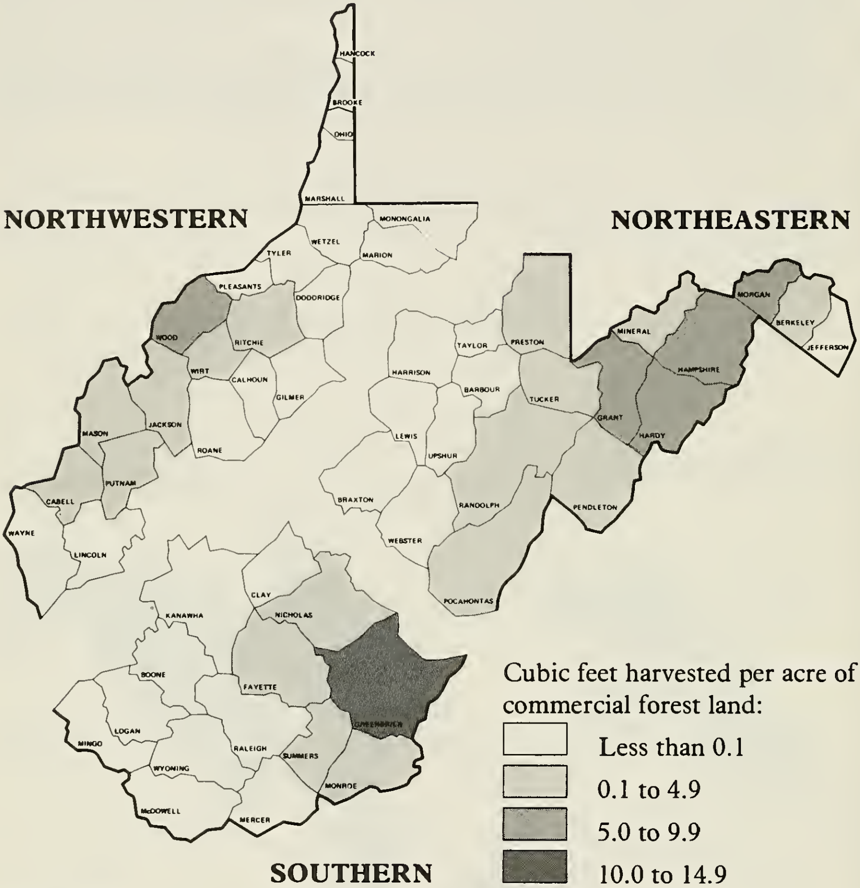
[5] It is important to note that the harvest intensity map (Figure 5a) on page 10 shows only the volume of roundwood cut per acre of commercial forest land and does not indicate whether or not a county is being cut too intensively. The degree of intensity or level of pulpwood harvests in a county is generally closely related to the location of pulp mills in the area.

Figure 5a. Intensity of the pulpwood harvest from roundwood, by county, West Virginia, 1981.



Source: [11].

OTHER TIMBER PRODUCTS AND INDUSTRIES

In 1979 about 15 percent of the state's timber harvest was used in the manufacture of veneer logs, mine timbers, and fencing. Lesser volumes were cut into cooperage and cabin logs, poles, dimension bolts, and stock for handles and wedges. The periodic surveys of West Virginia's timber industries do not, however, always canvass the use of other timber resources which have been emerging as small, but nonetheless, important aspects of the state's timber harvest. Among these new enterprises are Christmas tree production and the firewood industry.

THE VENEER HARVEST

In 1979, prior to the nationwide recession of 1981–82, the production and receipts of veneer logs in West Virginia were at or near record levels, three to five times greater than in 1974. That same year, production of veneer logs in the state reached an all-time high—over 8.5 million board feet. Receipts also hit record volumes in 1979 with West Virginia's three veneer mills receiving and manufacturing 23 million board feet of high quality logs.

Figures from 1980 almost duplicated the records of 1979, but production was down slightly to 7.5 million board feet. Veneer receipts, however, increased to 23.4 million board feet, setting a record for the second consecutive year [8]. Receipts in 1979 and 1980 were 539 percent greater than 1974 levels and 266 percent greater than the previous record year of 1968, when six veneer mills operated in the state. (See Table 5.)

Even though West Virginia exports some veneer logs, the state has historically been a net importer of veneer material. In 1980, West Virginia's veneer harvest accounted for only 21 percent of its receipts, while 79 percent was imported [8]. In 1979, loggers in Pennsylvania supplied 40 percent of all veneer logs imported by West Virginia. Virginia and Maryland each supplied about 20 percent and 10 percent came from New York. Nearly 90 percent of the imported veneer logs in 1979 were oaks; the remainder consisted mostly of ash, black cherry and elm [11].

Veneer log exports in 1980 were up 37 percent from the previous year, but with the demand for these logs so high in West Virginia, exports amounted to only 2.6 million board feet or 35 percent of the 1980 harvest [8]. This was quite

Table 5
Veneer log production and receipts, and number of operating plants in West Virginia, 1963–1980

Year	No. of Plants	Production	Receipts
		—MMBF—	
1963	5	7.0	6.3
1965	6	4.6	6.4
1968	6	7.9	8.7
1972	4	4.3	6.1
1974	4	3.2	4.3
1976	3	3.6	3.9
1979	3	8.5	23.0
1980	3	7.5	23.4

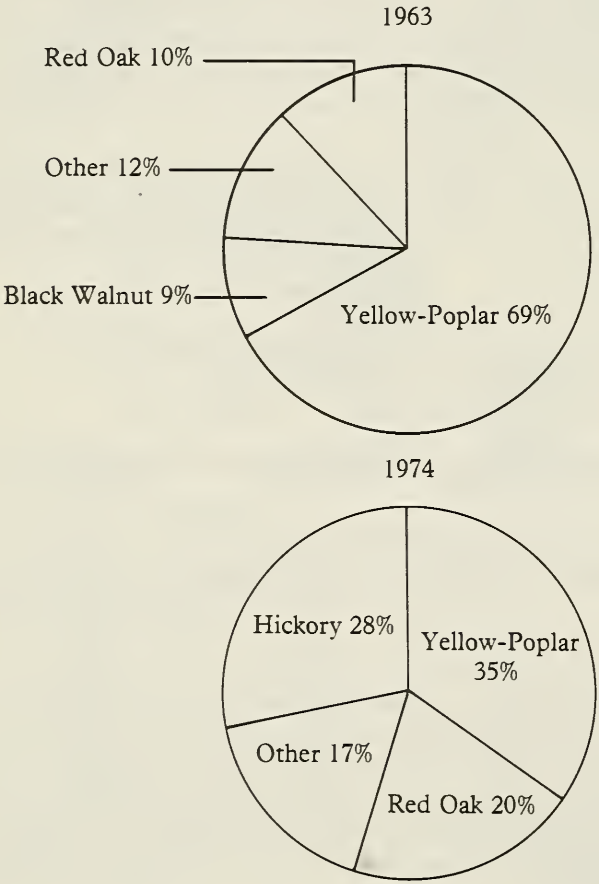
MMBF: millions of board feet.
Source: adapted from [11].

in contrast to the late 1960s and early 1970s when a much higher percentage of annual production was exported (Appendix Table A5), mostly to Virginia and Pennsylvania.

The species mix comprising the veneer harvest has changed considerably in the past 15 years (Figure 6). Changing consumer preferences, decline of the container veneer industry which used large volumes of yellow-poplar, and the availability of suitable high quality logs are the major causes behind the changes in this species composition.

In 1963, 69 percent of West Virginia's veneer logs came from yellow-poplar, 10 percent from red oaks, and 9 percent from black walnut. By 1979, red oak accounted for 57 percent of the total veneer harvest and white oak comprised 26 percent. Together, oaks accounted for 83 percent of the 1979 veneer harvest. Hickory, yellow-poplar, and ash each totaled about 4 percent.

Although the 1979 and 1980 veneer harvests were impressive, it will not be clear how the nationwide recession of 1981–82 has affected the state's veneer industry until production figures are collected from the post-recession period.


1963

1974

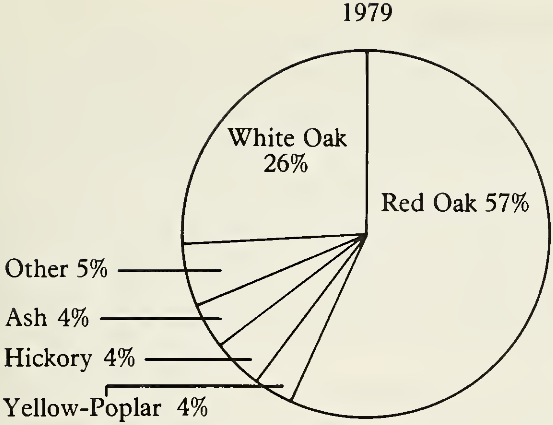


Figure 6. Percent of total veneer log harvest by species, West Virginia, 1963, 1974, 1979.

Source: [11].

MINE TIMBERS

Production of mine timbers in West Virginia closely parallels the economic cycles of the underground coal mining industry in the state. In 1969, when coal production was high, approximately 11 million cubic feet of wood was manufactured into mine timbers. But in 1974 only 6.7 million cubic feet of mine timbers were produced. In 1979, following an increase in coal production and an increased concern for mine safety, the production of mine timbers rose 13 percent over 1974 levels to 7.6 million cubic feet (Table 6). Hardwoods are most commonly used in mine timber production because of their strength and durability; softwoods accounted for less than 8 percent of mine timber production in 1979.

Table 6
Mine timber production in West Virginia,
1965, 1974, 1979

Year	1965	1974	1979
		—million cubic feet—	
Softwoods	.9	.5	.6
Hardwoods	10.1	6.2	7.0
Total Output	11.0	6.7	7.6

Source: [11].

COOPERAGE LOGS

Cooperage logs and bolts are used to make two types of wooden barrels; tight cooperage and slack cooperage. Tight cooperage is used to hold liquids; slack cooperage holds dry materials. Large, high quality white oak sawtimber is required to produce the clear, defect-free staves that are needed for tight cooperage. In West Virginia, tight cooperage for bourbon barrels was an important use of white oak for many years but has declined recently due to a drop in the demand for barrels. With changes in both product demand and the availability of high quality white oak, cooperage production in West Virginia fell from a high of 6.7 million board feet in 1949 to a low of 1.0 million board feet in 1979 (Table 7).

There were only three cooperage mills in West Virginia in 1979 and they utilized less than 2/10 of 1 percent of the state's total harvest that year. By 1984, there was only one cooperage stave mill operating in the state.

Table 7
Cooperage production in West Virginia
for selected years, 1949–1979

Year	Production —million board feet—
1949	6.7
1952	3.2
1960	1.5
1965	4.4
1974	3.2
1979	1.0

Source: [11].

RUSTIC FENCING

Rustic two- and three-rail fences have become popular with suburban home and estate owners during the last two decades, and West Virginia has capitalized on this increased demand. Between 1965 and 1979 the number of fence posts and rails produced in the state has risen more than four times and in 1979 more than 3 million pieces of rustic fence material were produced in West Virginia (Table 8).

While farmers and other rural residents still cut many rustic fence posts during slack periods and sawmills produce many of the rails, the industry has progressed to include several modern high-production mills which market a complete line of fencing materials.

Table 8
Production of rustic fence material in West Virginia, 1965, 1974, 1979

Year	Softwoods		Hardwoods		Total	% Change
	Posts	Rails	Posts	Rails		
	—thousand pieces-					
1965	8	0	238	477	723	
1974	89	912	582	577	2160	+199
1979	23	1167	874	1012	3076	+42

Source: adapted from [11].

Traditionally, most of the rustic fencing produced in West Virginia has been from hardwoods. In 1979, most posts were still made from hardwoods, while slightly more than half of the rails came from softwoods. Because of their form and durability, black locust, yellow-poplar, and sassafras were the most widely used hardwood species, while red spruce and hemlock were the most commonly used softwoods.

Rustic fencing has become the second most important minor timber product manufactured in West Virginia, accounting for 30 percent of all timber volume harvested for use in miscellaneous timber products in 1979. In addition, most of this comes from trees less than 12 inches dbh, and therefore subtracts little from the state's growing stock inventory.

MANUFACTURING RESIDUE

In 1979, more than 35 million cubic feet of wood residues were generated by primary wood manufacturers throughout the state. The residues consisted of mill waste such as slabs and edging, veneer cores, bark, sawdust, and shavings. Over the last few decades, manufacturing residues[6] have become a major source of inexpensive material for wood pulp mills, charcoal producers, fuelwood consumers, and other industrial facilities. Such usage has replaced traditional disposal methods, such as dumping and open burning.

In 1979, nearly 27 million cubic feet, or 75 percent of all residues were recovered and utilized in various industries. Fifty-two percent of the wood manufacturing residue produced in West Virginia was bought and converted into fiber by the pulp and paper industry.

Fuel was the second greatest use of residues, accounting for 16 percent of all residues produced. Charcoal manufacturing used 9 percent of the residues, while 1 percent was used as livestock bedding and mulch. Twenty-two percent of wood residues had to be disposed of by other means in 1979 (Figure 7). Ninety percent of the coarse residues, such as veneer cores, slabs, and edgings, was utilized, mostly by the pulp and paper industry. In addition, nearly 60 percent of the fine residue, such as sawdust and shavings, was recovered and used for pulp, fuelwood, or in charcoal production.

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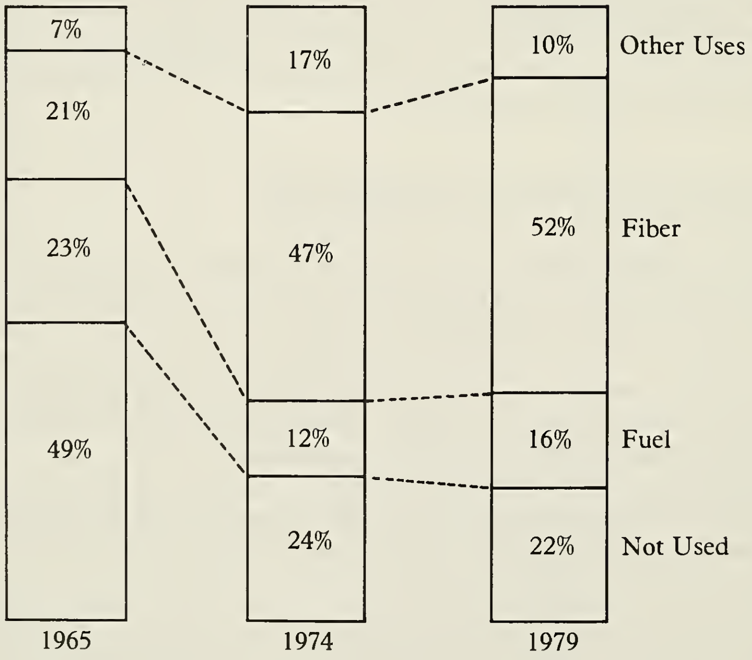
[6] Manufacturing residues—see definition of terms.

A comparison of 1979 manufacturing residue utilization levels and the levels of residue use in 1965 and 1974 shows:

- A greater percentage of the wood residues were used in 1979 (78%) than in 1974 (76%) and 1965 (51%).
- More wood residue was used for fuel in 1979 (16%) than in 1974 (12%), but less than in 1965 (23%).
- A substantially greater percentage of wood residues were utilized as pulpwood in 1979 (52%) and 1974 (47%) than in 1965 (21%)

These statistics show that primary wood manufacturing residues have increased in value and utility over time, and that West Virginia's primary manufacturers have become more efficient in utilizing surplus wood residue.

Figure 7. Trends in wood manufacturing-residue use in West Virginia, 1965, 1974, 1979.



Source: [11].

CHRISTMAS TREE PRODUCTION

Most Christmas tree production in West Virginia comes from established plantations which are not considered as commercial forest land and therefore are not included in the state's forest inventory. However, the Christmas tree industry has become an important economic segment among the state's small forest industries, generating $1,733,000 in sales in 1984 [6].

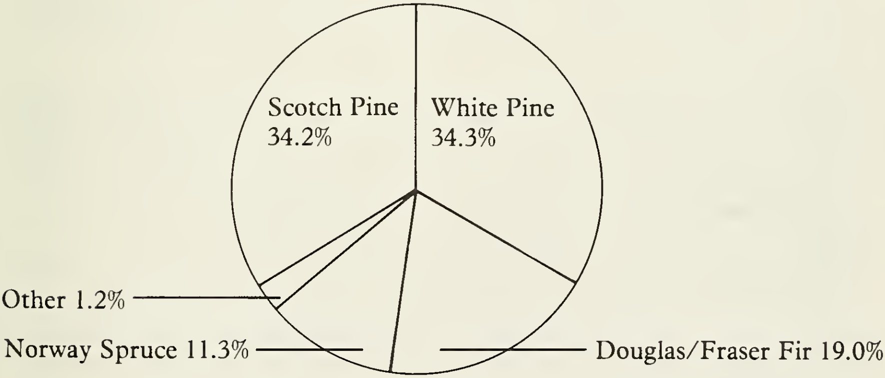
In 1984, approximately 171 Christmas tree growers in West Virginia harvested and sold an estimated 115,873 trees, down 17 percent from the record year of 1983, when 139,611 trees were sold for $1,967,066 [6]. (See Table 9.)

White pine was West Virginia's most popular species of Christmas tree in 1984, representing 34.3 percent of all trees sold. Scotch pine was nearly as important, accounting for 34.2 percent of tree sales. Douglas-fir and Fraser fir were next, with 19.0 percent of the market, while Norway spruce and miscellaneous species comprised the remaining Christmas tree sales in 1984 (Figure 8) [6].

Of the 1983 harvest, approximately 70 percent was marketed in-state and 30 percent sold out-of state. In 1985, West Virginia growers expected to market 122,000 trees and to plant an additional 400,000 trees [6].

Estimates of Christmas tree production through 1988 can be projected from the number of trees planted in recent years. Growers expect to increase Christmas tree production more than 100 percent by 1988 [6].

Figure 8. Christmas tree species marketed by West Virginia growers, in percent, 1984.



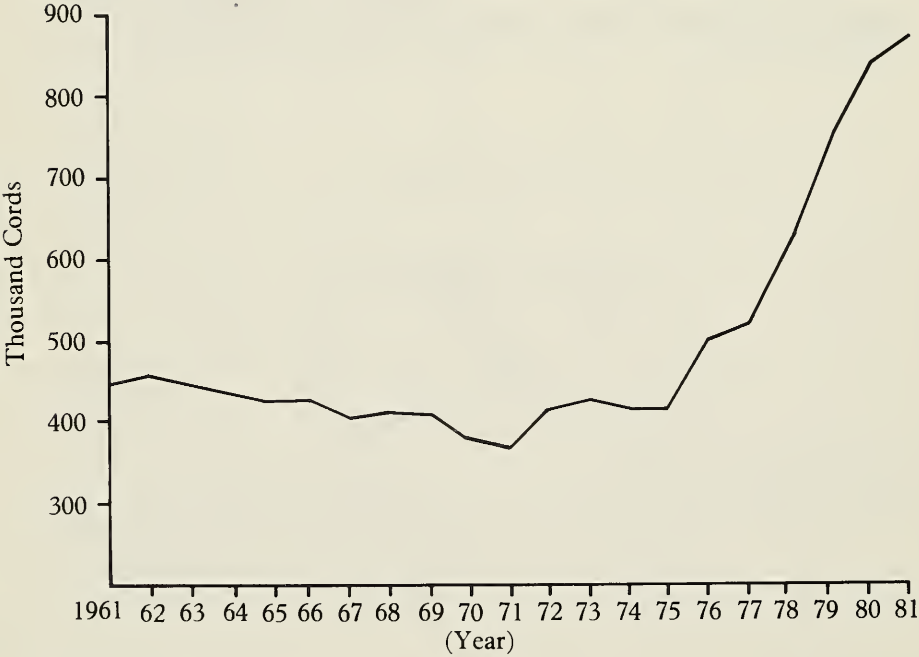
Source: [6].

Table 9
Christmas tree sales and number of growers in West Virginia, 1973–1984

Year	No. of Trees	No. of Growers
	—thousands—	
1973	126.2	238
1974	88.8	191
1975	86.8	164
1976	103.2	168
1977	95.6	175
1978	126.9	153
1979	110.1	162
1980	119.9	164
1981	119.0	180
1982	128.8	163
1983	139.6	171
1984	115.9	171

Source: [6].

Figure 9. Total fuelwood consumption estimates, West Virginia 1961–1981.



Source: [13].

FUELWOOD PRODUCTION

Over the past decade, fuelwood has been gaining in importance as a source of energy. This has been largely due to the increasing cost of alternative heating fuels since the Arab oil embargo of 1973. Since West Virginia is more than 80 percent forested and has ample supplies of fuelwood readily available and accessible, West Virginians have been increasing their consumption of woodfuel in both the industrial and residential sectors.

Fuelwood production figures for West Virginia are not available because the production of most round fuelwood is done on a part-time basis by many individuals and firms and is impossible to canvass. Total removals in terms of growing stock are equally difficult to document since most round fuelwood is cut from cull or otherwise unmerchantable trees or from trees that are less than 5 inches dbh. Therefore, consumption data is used as an estimate for total fuelwood production (Figure 9).

It can be assumed that West Virginia's production of fuelwood closely parallels its consumption, since timber suitable for fuelwood is so readily available in the state. Between 1975 and 1981, fuelwood consumption in the state increased by approximately 109 percent. Wood for fuel is a significant use of timber—the 1981 estimated consumption level, 874,000 cords, was almost twice as much as West Virginia's total 1982 pulpwood production from both roundwood and mill residues. It is estimated that by 1988 residential fuelwood consumption alone will reach 974,980 cords and top 1.1 million cords by 1992 [1].

THE ECONOMIC IMPORTANCE OF THE TIMBER HARVEST IN WEST VIRGINIA

Annual timber harvests in West Virginia represent a substantial financial return to forest land owners who decide to sell their timber. In 1979, West Virginia woodland owners received an estimated $39.68 million from the sale of timber stumpage.[7] Compared with other agricultural crops, the timber harvest in West Virginia ranked as the state's third largest cash crop in 1979, generating almost as much income to landowners as dairy products brought to farmers, which was surpassed in value only by the beef cattle industry (Table 10). In comparison, cash receipts from all other agricultural crops, excluding livestock and animal products, totaled only $61.7 million in 1979 [15].

The largest and most valuable component of the 1979 timber harvest was the sawtimber segment. Sawmills and other buyers of sawtimber stumpage paid an estimated $30.9 million to forest land owners. The income from sawtimber sales accounted for 78 percent of the 1979 timber harvest's total estimated value

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[7] Timber stumpage—see definition of terms.

(Table 11). The sale of timber for veneer logs and mine timbers also brought woodland owners considerable revenue but represented a much smaller percentage of the timber harvest's total value. Estimates of stumpage value were made for all segments of the timber harvest except miscellaneous wood products because of the relatively small volume of timber harvested for that purpose. Additionally, the estimated stumpage value for fuelwood was not included in the total harvest value because the woodfuel from manufacturing residue was already represented by some other harvest segment. Also, much of the fuelwood was consumed domestically without being sold and therefore did not generate cash receipts.[8]

The manufacture of primary and secondary wood products in West Virginia also generates jobs, income, and added value in the state. In 1977, 7,450 employees, or about 6.4 percent of the state's manufacturing labor force, was employed in wood-using industries (Appendix Table A6). They were paid more than $58.5 million in wages and salaries—3.6 percent of all manufacturing wages paid in the state that year. West Virginia's wood industries also accounted for roughly $130 million in value added by manufacture [12].

Primary wood products manufacture is the largest segment of the state's current forest industry. It includes logging contractors, sawmills, planing mills, and establishments which manufacture millwork, veneer, and structural wood members. These industries cut, transport, saw, slice, or otherwise prepare roundwood products for further manufacture or use. In 1977, this segment of the wood products industry employed 54 percent of all wood industry employees and 3.4 percent of all manufacturing employees statewide. These primary industries paid $30.6 million in wages and salaries and added $67.3 million in product value through the manufacture of raw wood material, converting it mostly into lumber [12].

The secondary wood products sector includes wood container manufacturers, wood preserving plants, wood furniture makers, paper product manufacturers, and other miscellaneous wood product firms. In 1977, this segment employed 46 percent of wood-using industry employees and paid $27.9 million in wages. Despite the relatively small number of establishments in this segment, it is almost as important as the primary wood products segment in terms of value—adding 66.2 million to the value of the wood products through manufacture [12].

Included in the secondary wood products industry is paper and allied products. Although West Virginia has no paper mills, the state does manufacture secondary paper products such as paperboard, bags, and cardboard boxes. The manufacture of paper and allied products accounted for $35.5 million in value added in 1977 while employing 1,600 people and paying $15.6 million in wages and salaries [12].

While the relatively small secondary wood products segment contributes much to the state's wood industry, it could be larger and contribute more to the economy of the state. Most of the lumber and wood products are shipped out-of-state after primary conversion to be manufactured into finished products elsewhere. Many millions of dollars in value added, and hundreds of jobs are lost in West Virginia by not manufacturing more finished wood products in the state. The lack of a larger and more diversified secondary lumber and wood products sector continues to keep West Virginia from realizing a greater return from its timber harvesting activities.

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[8] The value for fuelwood consumed in 1979 is $2,531,620—based on the estimated stumpage price for pulpwood.

Table 10

Relative ranking of West Virginia's cash crops, 1979

Product	Estimated Value
Cattle and Calves	$68,218,000
Dairy Products	$40,489,000
Timber Harvest	$39,688,000
Apples	$36,163,000
Eggs	$ 9,949,000
Peaches	$ 3,998,000
Hay	$ 3,245,000
Tobacco	$ 2,774,000
Corn	$ 2,033,000

Source: adapted from [15].

Table 11

Estimated stumpage value of the timber harvest in West Virginia, 1979

Product	Volume Harvested (millions of cu.ft.)	% of Harvest	Estimated Value (1979 dollars)
Sawlogs	65.1	73	30,893,019
Pulp wood	10.7	12	583,214
Veneer Logs	1.3	1	4,670,750
Mine Timbers	7.6	8	1,993,965
Fencing	4.1	5	276,000
Cooperage	*	*	200,000
Micellaneous	.5	1	*
Christmas Trees	*	*	1,071,200
Total	89.2	100	39,688,149

*Data not available or represents an insignificant volume.

TIMBER HARVEST SUMMARY

West Virginia's timber producers harvested and sold more than 89.3 million cubic feet of roundwood from the state's forest lands in 1979 for $39.7 million. The sawlog segment, which accounted for 73 percent of the total harvest, also accounted for 78 percent of the timber-related landowner income. However, the 1979 sawtimber harvest was almost 10 percent less than the harvest in 1974 and 23 percent less than 1965.

The pulpwood harvest, which accounted for 12 percent of the 1979 harvest, also declined throughout the 1970s, dropping more than 60 percent between 1965 and 1979. However, it had a dramatic turnaround beginning in 1980, and by 1982, a record pulpwood production level of 457 thousand cords was achieved.

West Virginia's veneer and rustic fencing industries also have shown substantial gains. In 1979, the veneer harvest reached a record 8.5 million board feet and veneer mill receipts were more than five times greater than in 1974. Rustic fencing production in West Virginia has been growing since 1965, and by 1979 showed an increase in fence posts and rail production of more than four times.

But these gains have come in relatively small segments of West Virginia's timber industries and account for only a small percentage of the state's total harvest. Overall, West Virginia's timber harvest activity has declined over most of the last two decades. The 1979 timber harvest was 16 percent lower than in 1974 and 32 percent less than in 1965, despite substantial growth in West Virginia's forest inventory.

DISCUSSION

Why has West Virginia's expanding timber resource not been more fully utilized? The basic explanation is that the state's wood products industry is dominated by the primary manufacture of lumber, and that hardwood lumber producers have faced tough economic and market conditions in the past two decades. During the late 1960s and through the 1970s, falling timber harvest and utilization levels in the state have been partly due to changes in relative production costs and consumer preferences which have hurt hardwood lumber products in general. Non-wood materials, most notably metals and plastics, are cheaper, consumer-accepted substitutes for traditional hardwood materials in such products as furniture, doors, windows and frames, casings, etc. With the increased popularity of wall-to-wall carpeting, the hardwood flooring market has almost disappeared. Even other wood products were outcompeting hardwood lumber; for instance, low-cost furniture made with wood veneer or woodgrain-printed paperboard, or plastic over plywood or particleboard core material, has been accepted by consumers as a substitute for solid wood furniture. Similar substitutes for solid hardwood paneling have also been accepted.

As a result of these market factors, total U.S. hardwood lumber production declined almost 3 percent (from 7.5 to 7.3 billion board feet) between 1965 and 1979. In the same period, U.S. hardwood lumber consumption dropped from 7.7 to 7.3 billion board feet, or about 5 percent [14]. But these figures are small when compared with the declines experienced in West Virginia's hardwood sawlog harvest and sawmill receipts. The state's sawlog harvest declined 23 percent between 1965 and 1979 (Table 3), while net sawlog receipts dropped 18 percent between 1974 and 1979 (net receipts figures for 1965 are not available). Clearly, the state's lumber industry fared worse than the total hardwood lumber market during this period. Apparently, factors beyond general market trends were hurting the performance of West Virginia's hardwood-based industries.

In addition to the general market factors just discussed, the recent decline in the state's lumber industry was probably made more severe by (1) the lack of a strong marketing program designed to promote the state's wood products, and (2) a weak secondary wood-using industry within the state.

Traditionally, several agencies including the West Virginia Department of Agriculture's Division of Forestry,[9] the West Virginia University Cooperative Extension Service, and the U.S. Forest Service's Forestry Science Laboratory at Princeton, W.Va. have engaged in wood products marketing efforts, but these efforts have generally been low-key. More recently, the Governor's Office of Community and Industrial Development has shown an interest in forest products marketing, but its efforts have not yet had time to yield significant results. Private wood industry firms, of course, promoted their individual product lines, but have not organized an industry-wide marketing effort of any kind. Because of this weak and uncoordinated marketing situation, West Virginia has lost opportunities to expand its wood product sales to existing markets, to develop new markets, and to attract new wood product enterprises [19].

According to the 1984 directory of West Virginia's Forest Industry, there are 140 secondary wood manufacturing establishments operating within the state, the majority of which are relatively small enterprises. This illustrates the low level of secondary wood products manufacturing activity in the state, which further limits the opportunity to market primary wood products. A larger, more diversified secondary wood-using industry would stimulate primary wood processing activity by offering an in-state market, low transportation costs, quick deliveries, etc.

Finally, higher levels of wood products production are hindered by the structure of West Virginia's wood industry. The industry is structured primarily to use large, high quality hardwoods—not the relatively abundant, small size, low quality timber which comprises a large part of the state's forest inventory. The large-scale utilization of small size, low quality timber would require the establishment of mills specifically designed to use such timber to make profitably marketable products. The production technologies do exist and active effort to attract such enterprises would promise several benefits, such as new employment opportunities, larger incomes to timberland owners, growth in the state's economy, and long-run improvement in the quality and utility of the state's timber inventory [19].

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[9] Formerly in the West Virginia Department of Natural Resources.

Further insight into the state's forest economy and its growth potential can be gained through a comprehensive analysis of the composition and structure of the state's wood-based industry, and by analyzing market trends and prospects for hardwood timber products. These analyses will be forthcoming in future volumes of the West Virginia Forest Development Series.

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APPENDIX A

Tables

A-1 West Virginia timber harvest by product, 1979.
A-2 Industrial timber harvest by product and geographic unit, West Virginia, 1979.
A-3 Sawlog production and receipts by species and shipments, West Virginia, 1979.
A-4 Sawlog production by type, unit, and destination of shipments, West Virginia, 1979.
A-5 Veneer log exports and imports in West Virginia for selected years, 1963–1980.
A-6 Economic statistics for West Virginia's wood products industries, 1977.

Table A-1

West Virginia Timber Harvest by Product, 1979

Product	Total Harvest	Hardwood Volume (in million cubic feet)	Softwood Volume	Percent of Total Harvest	Percent of Hardwoods	Percent of Softwoods
Sawlogs	65.1	62.0	3.0	72.9	95.4	4.6
Pulpwood	10.7	8.2	2.5	12.0	76.3	23.7
Veneer Logs	1.3	1.3	0.0	1.5	100.0	0.0
Cooperage Logs	0.2	0.2	0.0	0.2	100.0	0.0
Mine Timbers	7.6	7.0	0.6	8.5	92.0	8.0
Fencing *	4.1	2.8	1.3	4.6	68.5	31.5
Misc. products**	0.3	0.3	0.0	0.4	98.8	1.3
Total	89.3	81.8	7.5	100.0	91.6	8.4

Source [11].

*includes posts and rails.

**includes cabin logs, dimension bolts, poles, and handle stock.

Table A-2

Industrial timber harvest by product and geographic unit, West Virginia, 1979

Geographic Unit and Species Group	Sawlogs	Pulpwood	Other Products	All Products
		in thousands of cubic feet		
Northeastern				
Softwoods	1,701	1,980	978	4,659
Hardwoods	27,571	3,978	4,703	36,252
Total	29,272	5,958	5,681	40,911
Southern				
Softwoods	1,002	187	703	1,892
Hardwoods	25,286	3,460	4,595	33,341
Total	26,288	3,647	5,298	35,233
Northwestern				
Softwoods	317	374	232	923
Hardwoods	9,185	748	2,273	12,206
Total	9,502	1,122	2,505	13,129
All Units				
Softwoods	3,020	2,541	1,913	7,474
Hardwoods	62,042	8,186	11,571	81,799
Total	65,062	10,727	13,484	89,273

Source: [11].

Table A-3

Sawlog production and receipts by species and shipments, West Virginia, 1979*

Species	Total Production	Retained in State	Exported	Imported	Total Receipts
Hemlock	4.3	4.3	0.0	**	4.3
White Pine	4.3	4.3	0.0	**	4.3
Yellow Pine	2.0	1.5	0.5	0.1	1.6
Other Pines	0.1	0.1	0.0	0.0	0.1
Spruce	2.5	2.5	0.0	0.1	2.6
Other Softwoods	4.9	1.6	3.3	0.0	1.6
Total Softwoods	18.1	14.3	3.8	0.2	14.5
Ash	5.7	4.7	1.0	0.3	5.0
Basswood	8.5	7.9	0.6	0.2	8.1
Birch	3.4	3.4	**	**	3.4
Black Cherry	9.3	8.9	0.4	0.1	9.0
Cucumber	1.8	1.8		**	1.8
Black Gum	3.9	3.6	0.3	**	3.6
Hickory	19.4	14.7	4.7	0.2	14.9
Red Maple	13.5	11.5	2.0	0.3	11.8
Sugar Maple	17.1	14.7	2.4	0.1	14.8
White Oak	39.7	35.3	4.4	0.8	36.1
Chestnut Oak	38.2	32.4	5.8	0.8	33.2
Red Oak	77.3	65.2	12.1	0.9	66.1
Other Oaks	69.4	62.3	7.1	0.2	62.5
Black Walnut	2.1	1.6	0.5	0.0	1.6
Yellow-Poplar	64.9	58.9	6.0	0.8	59.7
Other Hardwoods	10.9	10.1	0.8	0.2	10.3
Total Hardwoods	399.2	349.5	49.7	5.0	354.5
All Species	417.3	363.8	53.5	5.2	369.0

Source: [11].

*In millions of board feet,
International 1/4-inch log rule.

**Less than 50 Mbf.

Table A-4

Sawlog production by type, unit, and destination of shipments, West Virginia, 1979.

Species Group and Geographic Unit	Retained in Unit	Shipped to Other Unit	Shipped to Other State	Total Production	Percent of Total
			in million board feet		
Softwoods					
Northwestern	8.2	**	2.0	10.2	56.4
Southern	4.2	**	1.8	6.0	33.2
Nothwestern	1.7	0.2	**	1.9	10.5
Total Softwoods	14.1	0.2	3.8	18.1	4.3
Hardwoods					
Northeastern	156.2	5.9	15.3	177.4	44.4
Southern	144.4	2.4	15.9	162.7	40.8
Northwestern	36.2	4.4	18.5	59.1	14.8
Total Hardwoods	336.8	12.7	49.7	399.2	95.7
All Species	350.9	12.9	53.5	417.3	100.0

Source: [11].

*International 1/4-inch log rule.

**Less than 50 MBf.

Table A-5

Veneer log exports and imports in West Virginia for selected years, 1953–1980

Year	Production	Exports	Percent of Production	Receipts**	Imports	Percent of Receipts
	(million board feet)*			(million board feet*)		
1963	7.0	4.5	64	6.3	3.8	60
1965	4.6	2.1	46	6.4	3.9	61
1968	7.9	5.1	65	8.7	5.9	68
1972	4.3	2.6	60	6.1	4.4	72
1974	3.2	2.6	81	4.3	3.7	86
1976	3.6	3.1	86	3.9	2.9	74
1979	8.5	1.9	22	23.0	16.4	71
1980	7.5	2.6	35	23.4	18.5	79

Source [11].

*International 1/4-inch rule.

**Total veneer logs received at West Virginia veneer mills—includes logs that remained within the state plus logs imported from out of the state.

Table A-6

Economic statistics for West Virginia's wood products industries, 1977.

S.I.C. Code	Industry	Number of Firms	Number of employees	Annual payroll (million of dollars)	Value added (million of dollars)
241	Logging camps & contractors	177	700	5.7	10.3
242	Sawmills & planing mills	218	2600	19.2	42.2
243	Millwork, veneer, plywood & structural wood members	17	700	5.7	14.6
Total	primary industries	412	4000	30.6	67.3
244	Wood containers	20	500	3.5	6.4
249	Misc. wood products	30	750	NA	NA
2491	Wood preserving	10	500	4.6	12.1
251	Wood furniture	17	600	4.2	8.6
26	Paper & allied products	28	1600	15.6	35.5
Total	secondary industries	95 *	3450 *	27.9	62.6
Total,	wood products industries	507	7450	58.5	129.9

Source: [12].

NA—Not available.

*Does not include SIC code 2491.

APPENDIX B:

Definition of Terms

Coarse Residues—Manufacturing residues suitable for chipping, such as slabs, edgings, and veneer cores [11].

Fine Residues—Manufacturing residues not suitable for chipping, such as sawdust and shavings [11].

Hardwoods—Dicotyledonous trees, usually broad-leaved and deciduous; oaks, maples, and hickories, for example [2].

Manufacturing Plant Residues—Wood materials that are generated when round timber (roundwood) is converted into wood products; includes slabs, edgings, trimmings, miscuts, sawdust, bark, shavings, veneer cores and clippings, and screenings [11].

Miscellaneous Wood Products—Those products, which when combined, comprise only a small percentage of the total volume of wood products manufactured in a given year. These generally include cooperage, cabin logs, dimension bolts, handle stock, and wedges.

Northeastern U.S.—Includes Connecticut, Delaware, Kentucky, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, and West Virginia.

Pulpwood—Roundwood or plant by-products cut, chipped, and prepared for manufacture into woodpulp [11].

Receipts—Cut timber such as sawlogs, veneer bolts, or pulpwood, which is received by mills for conversion into timber products.

Roundwood Products—Logs, bolts, and other timber generated from harvesting trees for industrial or consumer uses [11].

Sawlog—A log that meets minimum standards of diameter, length, and defect, including logs at least 8 feet long, and with a minimum diameter inside bark of 6 inches for softwoods and 8 inches for hardwoods [2].

Softwoods—Coniferous trees, usually evergreens, having needles or scalelike leaves; spruce, pine, and hemlock for example [2].

Standard Cord—A unit of measure for stacked wood encompassing 128 cubic feet of wood, bark, and air space. Cord estimates can be derived from cubic-foot estimates by applying a factor of 85 cubic feet of solid wood per rough cord [9].

Timber Harvest—Total production of round timber for conversiton into wood products [11].

Timber Stumpage—The value of marketable timber as it stands uncut in the woods; in a general sense, the standing timber itself.

Veneer—A thin layer of wood sliced from a veneer log, that is bonded to and used to cover a usually lower value material, such as plywood.

Veneer Log—A roundwood product from which veneer is sliced or sawn, that meets standards of diameter, length, and defect [8].

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FORESTS & THE WEST VIRGINIA ECONOMY

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Bulletin 691, *Forests and the West Virginia Economy*—
Volume 3: The Commercial Timber Harvest in
West Virginia

Key Abbreviations

S.I.C.=Standard Industrial Classification
n.e.c.=Not elsewhere classified

Authors

Kenneth D. Jones is research technologist and Gary W. Zinn is associate forest scientist in the Division of Forestry, West Virginia Agricultural and Forestry Experiment Station, West Virginia University.

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Agricultural and Forestry Experiment Station
College of Agriculture and Forestry
Robert H. Maxwell, Director
Morgantown

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FOREWORD

This is the fourth in a series of reports on West Virginia's forest resources. The series examines the forest resources, their current levels of utilization, their present role in the state's economy, the outlook for the future, and the prospects for increasing the economic contribution of forests and forest-based activity for the benefit of the citizens of West Virginia.

These reports focus mainly on timber resources and the timber-based economy. Observations are included on other forest resources and their uses including outdoor recreation, fish and wildlife, water, and wilderness, but these will not be covered in depth. Detailed research on the state's nontimber resources and their use is in progress and will be reported separately.

The research reported here was conducted under the auspices of the West Virginia Agricultural and Forestry Experiment Station at West Virginia University. Major financial support was provided by the West Virginia Governor's Office of Community and Industrial Development and by the Experiment Station. Other principal cooperators include the West Virginia Department of Natural Resources, the USDA Forest Service, and the West Virginia Forestry Association. The investigators gratefully acknowledge the support and cooperation of these agencies and organizations.

HIGHLIGHTS

1. In 1982, West Virginia's wood products industries shipped more than $381.1 million worth of products and added $160.4 million in value through manufacture.
2. In 1982, the state's wood industries employed approximately 6,400 workers in 436 establishments and paid $76.6 million in wages and salaries.
3. When compared to other manufacturing activities in 1982, the wood products industry represented about 26 percent of all manufacturing establishments in the state, 7 percent of all manufacturing employment, and 4 percent of all manufacturing payrolls.
4. Ranked among all West Virginia manufacturing industries in 1982, the wood product industry was fifth in employment, seventh in annual payroll, and seventh in value added.
5. West Virginia's timber-based industry is dominated by logging, sawmilling, and other primary wood manfacturing activities. Primary manufacturing facilities comprise 77 percent of all wood product plants in the state and employ about 57 percent of West Virginia's wood industry labor force. Combined, primary conversion activities generate about 48 percent of total wood industrial shipments, 47 percent of the industry's value added, and 51 percent of its payrolls.
6. From 1972–1982, the value of shipments from West Virginia's wood industry declined 23.5 percent, in constant dollars. During that same period, the industry's workforce declined by 2,400 and more than 100 establishments went out of business.

FORESTS AND THE WEST VIRGINIA ECONOMY

4. The Size and Economic Performance of West Virginia's Wood Products Industry

Kenneth D. Jones and Gary W. Zinn

INTRODUCTION

Wood-based industries began to develop in what is now West Virginia during the late 1700s, but didn't achieve economic importance until after the Civil War. During West Virginia's lumber boom era (1870–1920) the state was a lumber producer of national prominence. More than 30 billion board feet of lumber were produced during that era, but as the timber ran out so did the vitality of West Virginia's forest industry.

After World War II, West Virginia's wood products industry was seldom recognized as being an important part of the state's economic base and received little attention outside the industry itself. During the last 15 years, however, the state's forests have recovered sufficiently to offer new opportunities for wood-based enterprises. In fact, West Virginia now boasts the nation's eighth largest hardwood sawtimber inventory, a resource with the potential to support a billion dollar wood industry. However, it will be difficult for West Virginia's wood products industry to realize that potential soon, given its present structure and performance. Figures from the 1982 Census of Manufactures and an analysis of recent trends in the state's wood industry, indicate that a substantial decline has occurred in the state's wood-based economy since 1972 [15].

During the period 1972–1982, which includes the recession of 1980–82, the value of shipments from West Virginia's wood products industry declined 23.5 percent. Since 1972, the industry's work force has declined by 2,400, and more than 100 establishments have gone out of business.

Throughout this same period, the wood products industry performed about the same as manufacturing as a whole. In 1982, the state's wood products industries shipped $381.8 million worth of products and added $160.4 million of value through manufacture. But that is not good news, as the value added through wood products manufacturing still dropped by almost 35 percent in constant 1982 dollars.

When compared with other manufacturing activities in 1982, the wood products industry represented about 26 percent of all manufacturing establishments in the state, 7 percent of all manufacturing employment, and 4 percent of all manufacturing payrolls [15]. Overall, the wood products industry occupies a position in the state's economy similar to that of West Virginia's oil and gas extraction industry.

What about the future? Considering the size and growth rate of West Virginia's hardwood timber resource, it appears that the state's wood products industry is in an ideal position to make a more substantial contribution to the state's economy. But there are other factors, such as the lack of investment and operating capital, and the undiversified structure of the state's wood industry, which presently prevent this potential contribution from being realized. These and other adverse factors must be corrected before any substantial growth can be expected in the state's wood products industry in the near future.

OVERVIEW OF WEST VIRGINIA'S WOOD PRODUCTS INDUSTRIES

The wood products industry converts raw wood material into various semi-finished or finished products. The three major stages of production are timber harvesting, primary processing, and secondary manufacturing. The flow of raw wood materials through the manufacturing process also produces by-products and waste materials, some of which are reused while others must be disposed. The flow of raw wood material to and the product outputs from West Virginia's wood industry is illustrated in Figure 1.

The U.S. Bureau of the Census defines the wood products industry as all manufacturing activity in Standard Industrial Classification (S.I.C.) groups 24 (Lumber and Wood Products), 25 (Furniture and Fixtures), and 26 (Paper and Allied Products), exclusive of five specific activities in S.I.C. 25.[1] The activities represented by West Virginia's wood products industry are listed in Table 1.

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[1] These activities are S.I.C. 2514, 2515, 2519, 2522, and 2542; these involve manufacture of furniture principally from materials other than wood.

Figure 1. The flow of raw wood material to and the product outputs from West Virginia's wood industry.

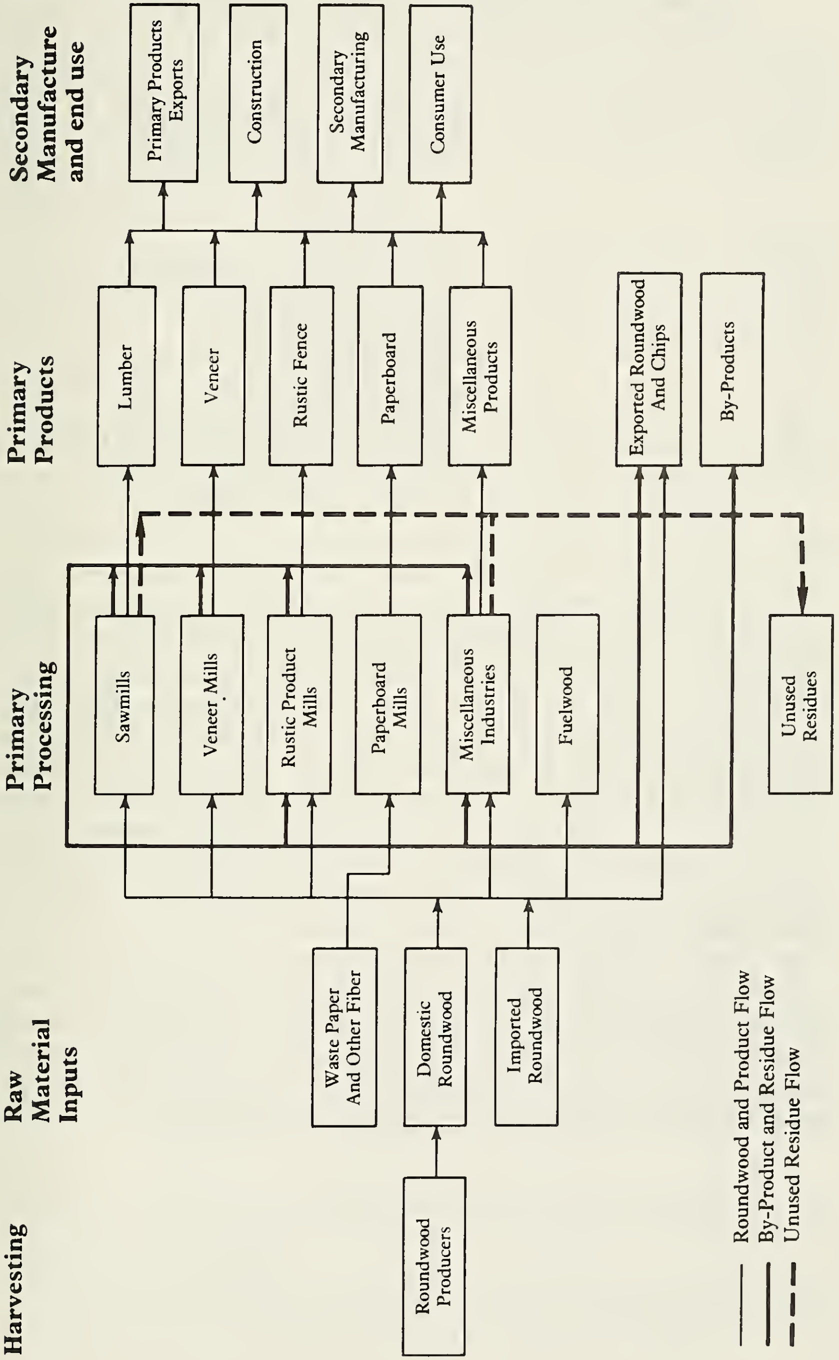

Table 1

Industry titles and standard industrial classification codes for wood product industries in West Virginia

S.I.C.	Industry Title
241	Logging camps and contractors
242	Sawmills and planing mills
243	Millwork, veneer, plywood, and structural wood members
244	Wood containers
249	Miscellaneous wood products
251	Wooden household furniture
252	Wood office furniture
254	Wood Partitions and Fixtures
263	Paperboard mills
264	Miscellaneous converted paper products
265	Paperboard containers and boxes
286	Gum and wood chemicals

Source: [13].

S.I.C. groups 241 (Logging camps and contractors), 242 (Sawmills and planing mills), and the veneer segment of group 243 (Millwork, veneer, plywood, and structural wood members) are considered to be primary manufacturing activities: they are involved in the actual cutting, transportation, and primary conversion of wood raw materials. The remaining S.I.C. groups comprise West Virginia's secondary wood products industry. The distinction between primary and secondary manufacturing is often unclear, especially when firms use both raw materials and wood that have already undergone some processing. To avoid confusion this analysis will utilize the classification of primary industries found in Phelps [8]. (See Appendix Table A1.)

The primary segment has the greater number of firms and level of production, and has generally dominated the state's wood industry. West Virginia has never had a highly developed secondary wood industry and has exported most of its lumber to be manufactured into finished products elsewhere. This pattern of manufacturing has kept the state from achieving greater wood industry employment and higher product values.

INDUSTRY SIZE AND ECONOMIC PERFORMANCE ACCORDING TO THE U.S. CENSUS OF MANUFACTURES

The 1982 Census of Manufactures reported 436 wood product establishments operating in West Virginia. They employed 6,400 people and had an annual payroll of $76.6 million. In 1982, the state's wood industries shipped an estimated $381.8 million worth of products, while adding $160.4 million in value through manufacture (Table 2).

West Virginia's primary wood industry segment produced $183.7 million in value of shipments in 1982, according to the Census of Manufactures estimate. The 355 primary wood industry establishments listed in the Census purchased $109.2 million worth of materials and added an estimated $74.5 million in value through manufacture. These establishments employed about 3,700 workers and paid $38.8 million in wages and salaries.[2]

The secondary segment of the state's wood industry consisted of 81 firms which employed approximately 2,700 workers and had an annual payroll of $37.8 million in 1982. These firms shipped $198.1 million worth of solid wood and paper products while adding $84.2 million through manufacture.[3]

The US Census data can be put in context by comparing it with other selected manufacturing activities within the state. Ranked among all West Virginia manufacturing industries in 1982, the wood products industry was fifth in employment and seventh in annual payroll and value added (Figure 2). It accounted for 6.6 percent of all manufacturing employment and 3.8 percent of all manufacturing payrolls.

Statistics for that same year, however, show that the wood products industry represented less than 1 percent of the state's total working labor force and that wood industry payrolls accounted for less than 0.5 percent of West Virginia's personal incomes [18].

At first glance, the contribution of West Virginia's forest-based industries appears to be modest at best. In some counties, however, wood-based industries are an important part of the economy. For example, wood processing represents nearly all manufacturing in Webster County, is of notable importance in Randolph, Braxton, Preston, and Greenbrier counties, and is of modest significance in Kanawha, Mercer, Upshur, and Wayne counties. Economic activity for these nine counties in 1981 is given in Table 3. In four of them more than 250 people were employed in the lumber and wood products industry alone (S.I.C. 24). In the nine counties together, lumber and wood products accounted for almost 10 percent of manufacturing employment, 5.8 percent of annual payroll, and 31.8 percent of manufacturing establishments [19].

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[2] Values do not include the contribution of the state's two veneer mills nor the state's two paperboard mills. Values for these industries could not be separated and are included in statistics for the secondary industry segment.

[3] The 81 firms reported in the census figures for the secondary wood industry include those firms in the furniture and fixtures industry (S.I.C. 25) which use non-wood materials as their principal input. Because of the nature of the census data, these firms could not be separated.

Figure 2. Comparison of the wood industry with other major manufacturing industries in West Virginia, by employment, payroll, and value added, 1982.

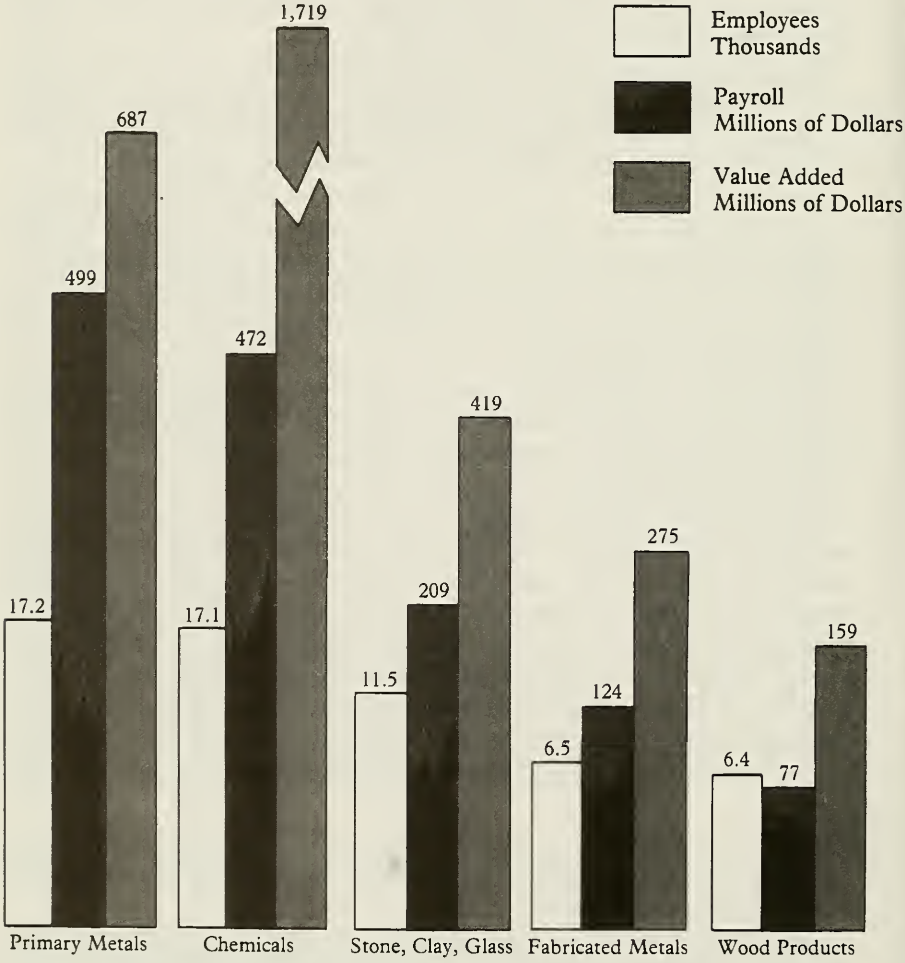

Table 2

Size and economic performance of wood product industries, West Virginia, 1982

S.I.C. Code		No. of Firms	No. Of Employees	Annual Payroll	Value Added	Cost of Materials	Value of Shipments	Cap.* Exp.
				millions of dollars				
24	Lumber and wood products**	375	4,200	45.0	91.1	122.6	212.0	5.9
2411	Logging camps and contractors	122	800	7.7	15.9	21.0	37.1	2.0
242	Sawmills and planing mills	188	2,200	22.2	42.2	60.6	101.9	2.3
2421	Sawmills, general	181	2,100	20.7	39.6	56.9	95.5	D
243	Millwork, veneer, structural wood members	20	500	6.2	15.9	13.4	28.3	0.4
25	Furniture and fixtures	36	900	10.7	22.5	38.7	60.2	0.5
251	Wood household furniture	20	D	D	D	D	D	D
26	Paper and allied products	25	1,300	20.9	46.8	61.8	109.6	3.0
265	Paperboard containers and boxes	11	500	9.9	17.0	30.4	48.0	D
	Total, Wood products industries	436	6,400	76.6	160.4	223.1	381.8	9.4

* Cap. Exp. = Capital Expenditures.

** The 3 and 4-digit S.I.C. codes do not sum to total 2-digit code due to the nature of the data.

D: not available due to disclosure laws.

Source: [15].

Table 3

Lumber and wood products industry (S.I.C. 24) activity in selected counties, West Virginia, 1981

County	S.I.C. 24 Economic Activity			Percentage of all Manufacturing in County			
	No. of employees	Annual payroll ($ mil.)	No. of establishments	No. of employees	Annual payroll	No. of establishments	Rank: ann-payroll
Braxton	68	.700	8	29.9	29.9	47.0	3
Greenbrier	250	2.882	17	17.8	16.4	47.2	5
Kanawha	531	6.924	16	3.4	2.0	10.1	9
Mercer	167	2.373	9	7.7	7.0	15.0	7
Preston	262	3.230	11	27.3	27.9	42.3	4
Randolph	578	6.051	26	41.6	44.0	63.4	2
Upshur	156	1.334	12	15.0	8.9	46.2	6
Wayne	189	1.906	17	10.0	6.6	41.5	8
Webster	167	1.253	13	96.6	97.4	76.5	1
Total nine counties	2369	26.653	129	9.7	5.8	31.8	

Source: [19].

INDUSTRY SIZE AND ECONOMIC PERFORMANCE ACCORDING TO OTHER SOURCES

Apart from the census data, available information on West Virginia's wood products industry is very general and scattered among several sources. A recent survey, conducted by Edward Murriner of West Virginia's Department of Agriculture, gives some information for the year 1981 and is shown in Table 4.

According to Murriner, more than 16,700 workers were employed in the state's wood products industry and were paid $135 million dollars in wages and salaries in 1981. The 1,098 wood product establishments had annual sales totaling more than $484 million [19].

Table 4
Number of establishments, employment, annual wages, and annual sales for West Virginia wood product industries, 1981

Activity	Number of establishments	Employees	Annual wages	Annual sales
Logging	587	3,522	14.09	34.41
Lumber, wood products, & furniture manufacture	483	11,591	102.42	371.16
Paper products manufacture	28	1,600	15.60	78.70
Total	1,098	16,713	135.11	484.27

Source: [19].

Comparison of the US Census survey to Murriner's survey reveals large differences in the number of establishments, employees, and annual wages. Although the surveys were not conducted in the same year, one would not expect to find such large differences from one year to the next. Specifically these are.

Source of estimate	Number of establishments	Number of employees	Annual Wages ($ mil.)
Murriner (1981)	1,098	16,713	135.1
Census of Manufactures (1982)	436	6,400	76.6

Much of the difference can probably be explained by the fact that Murriner's survey included part-time sawmill operations and a substantially larger number of roundwood producers. These operations employ only a few workers per establishment. The census does not accurately canvass these smaller firms and thus misses many establishments with few employees. Consequently, census figures probably underestimate the number of establishments and to a lesser extent employment and payrolls in West Virginia's wood-based industries. Murriner's figures, therefore, probably represent a more realistic estimate of the overall size of West Virginia's wood industry.

It also should be noted that the Census of Manufactures does not include tree farms and nurseries, private forestry services, retail lumber outlets, the transportation and marketing of timber and wood products, nor the substantial number of state and federal workers who manage public forests in West Virginia. In 1972, an estimated 10,070 people were employed in these aspects of the forest industry [8]. The value added attributed to timber management, transportation, and marketing in West Virginia was estimated to be $204.7 million in 1982 (Appendix Table A2).

But Murriner's survey collected only the most basic information concerning each establishment. Additional economic data concerning West Virginia's wood products industry must be gleaned from other sources. Although some sources, such as the US Census, provide more information, it is not possible to break down S.I.C. groups to analyze individual industries because of disclosure laws. To get more specific information, it is necessary to depart from census data in favor of a more activity-oriented approach.

In 1984, the West Virginia Department of Natural Resources, Division of Forestry, published an updated *Directory of West Virginia's Forest Industry.* It was compiled from information provided by county service foresters and subsequent responses to a mail questionnaire. Although the directory is not all-inclusive, it does provide the most comprehensive listing of West Virginia's forest industry (Table 5).

The number of establishments listed in the directory almost agrees with the number of establishments reported by Murriner in 1981. Most prominent among West Virginia's wood manufacturing establishments are roundwood producers, sawmills, and rustic product mills. In contrast, secondary manufacturers comprise only 23 percent of all wood product manufacturing plants in the state.

Table 5
Wood product establishments in West Virginia, by location and type, 1984

Type of Plant	Geographic Unit Northeastern	Northwestern	Southern	Total
Roundwood producers*	205	83	109	397
Sawmills	118	76	65	259
Custom mills	72	81	13	166
Rustic products	29	0	3	32
Veneer mills	1	1	1	3
Log and bolt mills	4	0	1	5
Paperboard mills	1	1	0	2
Chip mills	1	0	1	2
Roundwood concentration yards	5	6	1	12
All secondary wood manufacturers	63	43	34	140
Total	498	290	228	1,016

*Roundwood producers data from the *Directory of Roundwood Producers in W. Va.,* July 1981, WVU Center for Extension and Continuing Education. WV-OSH-4; 1984 data for this industry is not available.

Source: [17].

THE PRIMARY WOOD INDUSTRY SEGMENT

West Virginia's primary forest products industry includes those establishments which are actively engaged in the cutting, transportation, sawing, slicing, chipping, or other initial processing of raw wood. In West Virginia this includes logging camps and contractors (S.I.C. 2411), sawmills and planing mills (S.I.C. 2421), hardwood dimension and flooring (S.I.C. 2426), special product mills (S.I.C. 2429), hardwood veneer manufacturing facilities (S.I.C. 2435), paperboard mills (S.I.C. 2461), and firms producing gum and wood chemicals (S.I.C. 2861). Complete definitions for these industries can be found in Appendix Table A1.

Logging (241) and sawmilling (242) account for the majority of the primary industry's manufacturing. In 1982, they produced $139 million worth of wood products and added $58.1 million in value through manufacture. They also employed 3,000 workers and paid $29.9 million in wages and salaries. When the remaining primary industries are included, it is estimated that the primary industries generate about 48 percent of total wood industry shipments, 47 percent of its value added, 51 percent of its payroll, and employ about 57 percent of West Virginia's wood industry labor force.

Primary manufacturers comprise 77 percent of all wood product manufacturing plants listed in the 1984 directory.[4] Sawmills account for 43 percent of all wood product plants in West Virginia. Custom sawmills, mainly small, individually owned, part-time operations, account for another 27 percent, so that altogether sawmills account for 70 percent of all wood product plants in the state.

Logging Camps and Contractors

Roundwood producers represent the greatest number of wood industry establishments in West Virginia. These firms represent the first stage in the wood manufacturing process—timber harvesting and transportation. In the past, logging was a very labor intensive operation, but with the invention and use of modern mechanical harvesters, skidders, loaders, and tandem trucks, logging enterprises now require large amounts of capital investment to remain productively and economically efficient. Although some large sawmills and other wood industries have diversified into timber harvesting to assure themselves of a dependable raw material supply, independent logging contractors still form the bulk of West Virginia's timber harvesting enterprises (Table 6).

Table 6
Roundwood producers by ownership and
geographic unit, West Virginia, 1981

	Geographical Unit			
Producers	NE	NW	S	Total
Individual	183	57	98	338
Company	22	26	11	59
Total	205	83	109	397

Source: [16].

Economic data relating to logging contractors (S.I.C. 2411) was obtained from the 1982 Census of Manufactures, which reported 122 logging establishments in West Virginia employing approximately 800 workers.[5] Eighty-five percent of all logging contractors had less than ten employees, and only five firms had more than twenty employees [15]. The annual payroll for all employees was $7.7 million, with production workers, on average, being paid $10,286 per year. The industry accounted for $15.9 million in value added by manufacture while shipping nearly $37.1 million worth of products. The industry's cost of materials, principally timber stumpage, amounted to $21 million.

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[4] Percentages based on exclusion of roundwood producers and wood concentration yards.

Wood Concentration Yards and Chip Mills

Timber is a heavy, bulky, raw material that must be transported, at considerable cost, from the harvest location to various manufacturing sites. When possible, primary wood-processing plants attempt to locate close to available timber supplies, but often it is still necessary to transport timber from distant locations. To avoid unnecessary transportation and to help ensure adequate raw material supplies, timber is often concentrated at strategic locations prior to marketing or processing. Most sawmills maintain a wood storage yard adjacent to the mill but some have established additional wood concentration yards away from the mill. These yards, usually located on rail lines, enlarge the mill's procurement area and allow more flexibility in gathering and sorting roundwood: they also allow better control of timber flow into the mill's main woodyard. Concentration yards also facilitate timber brokerage—selected logs are sometimes marketed directly from these concentration yards to other mills or for export.

Consider the case of Westvaco Corporation, which draws a considerable volume of pulpwood from West Virginia to supply its pulp and paper mills at Luke, Maryland, and Covington, Virginia. To facilitate roundwood procurement, Westvaco has established six wood concentration yards in West Virginia to accumulate roundwood until it is needed or can be transported in bulk. Westvaco also operates a chip mill at Inwood, Berkeley County, West Virginia. It can produce 500 tons of woodchips per day from tree length pulpwood. These chips are then transported via rail or truck to the pulp and paper mill at Luke.

Awegot of West Virginia, Inc. also operates a chip mill at Deepwater, Fayette County, West Virginia. It has capacity of approximately 220 tons per day and produces metallurgical chips. These wood concentration yards and chip mills employ approximately 50 people and facilitate the movement and processing of wood raw material throughout West Virginia.

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[5] The number of logging contractors reported in the census is substantially less than reported in the roundwood producers directory of 1981. Consequently, census figures for employment and value statistics are probably underestimated.

Sawmills

With 1982 lumber shipments valued at approximately $101.9 million, lumber is West Virginia's single most valuable timber product. In 1979, 75 percent of the annual timber harvest went into lumber production with West Virginia's sawmills receiving 369 MMBF[6] of sawlogs that year. These logs were sawn mainly into grade lumber, mine timbers, railroad ties, house logs, dimension stock, and cooperage. The sawing process also produced large volumes of wood residues, a large portion of which were converted into wood fiber, charcoal, and other wood products, or were burned as fuel.

In 1984, 259 sawmills with annual capacities over 100 MBF were operating in West Virginia [17].[7] Trends in the number of sawmills showed a consistent decline in the period 1965–1979 (Table 7). Most of this decline occurred in the low-production mills (less than 1 MMBF/year), but the number of high-production mills also declined during that time [6]. There were an additional 58 sawmills reported operating in West Virginia in 1984 as compared to 1979; although not conclusive, this may indicate a post-recession recovery in the lumber industry.

Forty-four percent of West Virginia's sawmills produced less than 500 MBF of lumber per year in 1984. Sixty-two percent were producing less than 1 MMBF annually. Only 38 percent of all sawmills in the state were categorized as high-production mills capable of producing more than 1 MMBF of lumber annually. Only four sawmills had a reported production capacity of 10 MMBF or more per year.

Total sawmill capacity for the state in 1984 was reported to be at least 287.85 MMBF/year with a maximum capacity in excess of 606.25 MMBF/year [17].[8] The US Bureau of the Census Lumber Production and Millstock Reports show that in 1984 West Virginia's sawmills produced only 285 MMBF of lumber.

The northeastern region of the state had the greatest concentration of sawmills with Randolph and Preston counties reporting the highest lumber-producing capacities in the region. Nicholas County, in the southern region, had the largest number of high-production mills in the state and the highest sawmilling capacity in the state as well (Figure 3).

Lumber production in West Virginia is moderately concentrated among four wood product companies—Coastal Lumber Company, Todco Inc.,[9] Georgia-Pacific Corp., and Interstate Lumber Company. These companies account for 22-30 percent of the state's lumber-producing capacity. Coastal Lumber Company, with its recent purchase of Geneva Lumber Company now has the highest sawmill capacity in the state with the capability of producing 60 MMBF of lumber annually at its five sawmills.

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[6] BF=Board feet.
MBF=Thousand board feet.
MMBF=Million board feet.

[7] 100 MBF per year is considered minimum capacity for a full-time sawmill enterprise.

[8] See Appendix Table A3 for explanation of production ranges.

[9] Todco, Inc. recently sold three of its four West Virginia sawmills.

West Virginia's sawmill industry includes many small, individually or family-owned low-production sawmills. Individuals own 39 percent of all sawmills producing over 100 MBF, but account for only 7-11 percent of the state's sawmill capacity. Family-owned enterprises represent 32 percent of West Virginia's sawmills and account for 28-31 percent of sawmill capacity. Together these two ownerships represent 71 percent of all sawmills producing over 100 MBF and 35-42 percent of the state's lumber-producing capability. In contrast, large corporations account for 6-8 percent of sawmill capacity while representing only 2 percent of sawmill ownerships. However, the bulk of the state's lumber production—53 to 65 percent—comes from independent lumber companies, which represent 19 percent of the state's sawmills with annual capacities greater than 100 MBF (Figure 4).

The circle saw is the most common headsaw used in West Virginia. In fact, this was the only saw used by sawmills with an annual production capacity less than 1 MMBF. Only 18 band saws were operating in West Virginia in 1984 and all but three of these mills were producing over 5 MMBF annually. Associated sawmill equipment currently being used in West Virginia sawmills is presented by mill size class in Table 8. One important observation is the fact that only 13 of the state's sawmills reported any kiln drying capacity.[10] This low level of kiln drying is a major constraint to secondary wood manufacturing in the state.

Sawmills and planing mills,[11] and special product sawmills, n.e.c.,[12] are all grouped under S.I.C. code 242 by the US Bureau of the Census. Together these firms employed 2,200 workers in 1982, with an annual payroll of $22.2 million, based on 188 reported establishments. These establishments spent $60.6 million for materials and had a value of shipments of $101.9 million—27 percent of shipment values for the entire wood products industry. Estimated value added for the sawmill industry was $42.2 million—26 percent of all value added through wood products manufacturing. In addition, the sawmill industry accounted for 34 percent of all wood manufacturing employment and 29 percent of the wood industry's annual payroll [15].

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[10] An independent study reported 23 sawmills having dry kilns [1].

[11] Planing mills are defined as mills being primarily engaged in the manufacture of hardwood dimension stock and flooring.

[12] n.e.c.=Not elsewhere classified.

Table 7

Number of sawmills, by geographic unit and annual production class, West Virginia, 1965, 1974, 1979, 1984*

Geographic Unit	Production Class**								Total			
	More than 1 MMBF				Less than 1 MMBF but greater than 100 MBF							
	1965	1974	1979	1984	1965	1974	1979	1984	1965	1974	1979	1984
Northeastern	55	37	31	40	78	53	62	78	133	90	93	118
Northwestern	18	15	12	22	59	62	38	54	77	77	50	76
Southern	21	38	34	37	35	22	24	28	56	60	58	65
Total	94	90	77	99	172	137	124	160	266	227	201	259

* Figures for 1984 from the *1984 Directory of West Virginia's Forest Industry.*

** Based on sawlog receipts or reported annual lumber production capacity.

Source: [6].

Figure 3. Location of sawmills producing 1 MMBF or more per year, West Virginia, 1984.

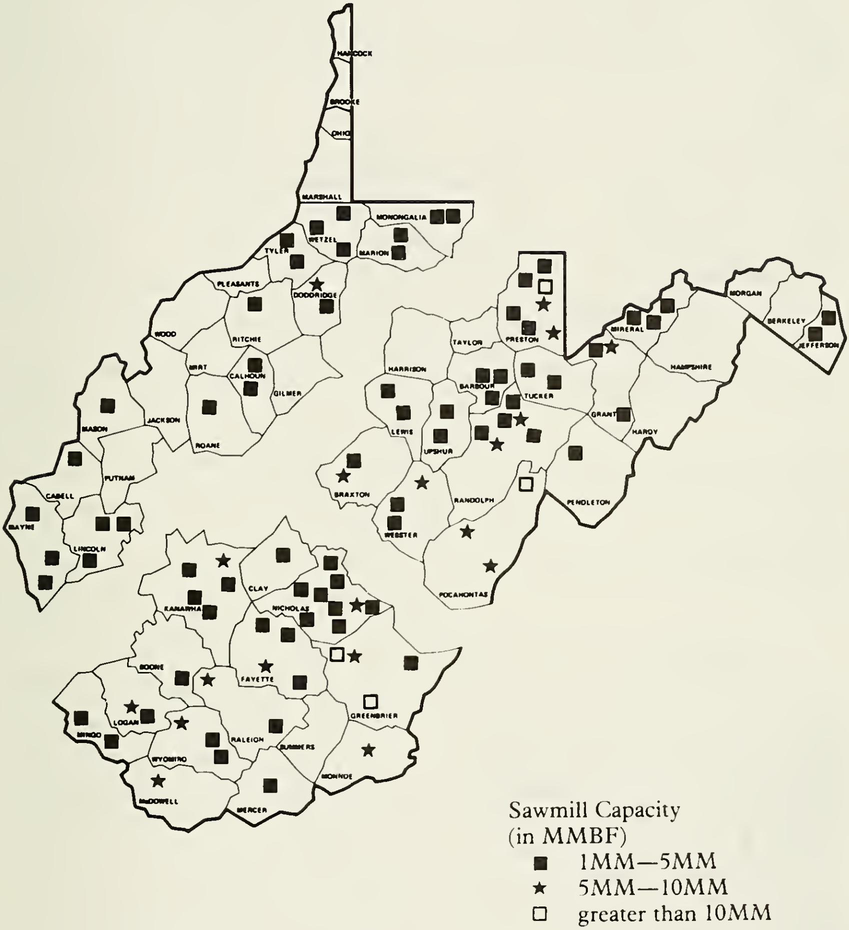

Figure 4. Sawmill ownership and lumber-producing capacity by ownership, West Virginia, 1984.

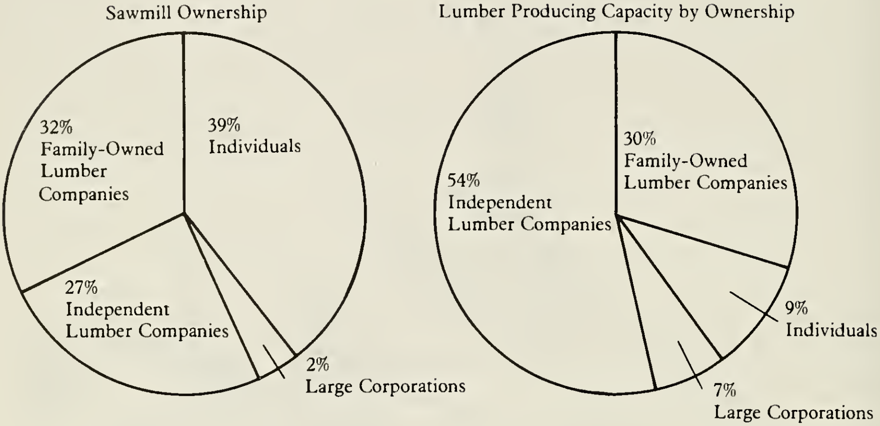

Table 8
Equipment used in West Virginia sawmills by mill size, 1984

Type of Equipment	Mill Size Less than 1 MMBF	 1–5 MMBF	 Greater than 5 MMBF
All Mills	155	78	26
Headsaw			
Circle	155	75	11
Band	0	3	15
Resaw	0	1	9
Scragg saw	0	3	1
Planer	3	6	8
Chipper	4	37	25
Debarker	4	40	25
Dry kiln	1	5	7
Treating plant	0	7	4
Other	2	5	3

Source: [17].

Veneer Mills

Veneer is a thin layer of wood sliced from a log. Layers of veneer are bonded together to form plywood; high-quality (face) veneers are also used as surface layers over less expensive materials such as particleboard [6]. Veneer can be categorized into three types based on its use: 1) commercial and face veneer is used in the plywood and furniture industries, 2) container veneer is used in fabricating baskets and produce containers, and 3) specialty veneer is used in manufacturing a variety of products such as toothpicks, tongue depressers, swizzle sticks, etc.

As late as November, 1984, West Virginia had three commercial veneer plants in operation. As of January, 1985, one plant could not be contacted and was assumed to have ceased operations. The two remaining veneer manufacturers, The Dean Company of Princeton, West Virginia and the Erath Veneer Corporation of Martinsburg, both produced commerical and face veneer for domestic furniture and plywood industries and for export to Canada, Europe, and the Orient. The manufacture of commercial and face veneer requires high-quality logs which must meet exacting specifications. Logs of desirable species and quality are not always available locally and must often be imported from great distances at a high cost.

Production at West Virginia's veneer plants in the 1980s has been more than five times that of the mid-1970s. In 1980, veneer log receipts at West Virginia veneer mills totaled 23.4 MMBF. Currently the veneer industry has the capacity to produce approximately 140 million ft.^{2} of veneer annually and employs about 180–200 people. Due to disclosure laws additional economic data is not available.

Paperboard Mills

Presently, paperboard manufacturing within West Virginia involves the reprocessing of waste paper into fibers than can be manufactured into paperboard, linerboard, and other converted paper products. The recycling process requires the waste paper to be ground and mixed with water and chemicals to form a pulp, which is then reformed into paper. Two companies are now recycling paper into paperboard products in West Virginia.

The Banner Fiberboard Company, located in Wellsburg, West Virginia, used about 12.5 tons of waste paper to produce approximately 12 tons of processed fibers in 1984. The processed secondary fiber is then sold and manufactured, primarily into linerboard, outside the state.

The Halltown Paperboard Company, in Jefferson County, is a much larger refiner of recyclable papers. It uses about 65,000 tons of waste paper annually to produce about 50,000 tons of paperboard per year.

About 220 workers are employed in West Virginia's paperboard industry, but due to disclosure laws no other economic data is available. All economic activity from paperboard manufacturing is included in the statistics for S.I.C. code 26 in Table 2.

Other Primary Industries

In addition to the industries already discussed, the primary wood industry in West Virginia also includes several specialty wood product manufacturers. Among these, rustic product mills are the most numerous. The 1984 directory of West Virginia's forest industry listed 32 such firms producing a variety of products including rustic fencing, locust posts, landscaping timbers, and firewood. In 1979, the state's rustic fence industry produced over 3 million pieces—most of which were exported to markets in the eastern United States.

Aside from fencing, several log and bolt mills manufacture such specialty products as log homes, handle blanks, crib block, and stave blanks. All economic activity generated by these rustic product mills is included in the census statistics for S.I.C. code 242 (sawmills and planing mills).

Charcoal manufacturing is included under S.I.C. group 2861 (Gum and Wood Chemicals). Presently, only one firm manufactures charcoal in West Virginia—Kingsford Charcoal Company in Parsons, Tucker County. It uses sawmill residues and charcoal dust to produce charcoal briquettes. it has been estimated that the plant converts approximately 300,000 tons of chips, bark, and dust into about 75,000 tons of charcoal per year. The plant employs about 160 workers.

Athough no firm in West Virginia is presently manufacturing wood chemicals, techologies do exist that allow ethanol, cattle feed, absorbants, and other derivatives to be produced by breaking down wood fiber into its various chemical components.

Economic statistics for S.I.C. 2861 are not available due to disclosure laws.

THE SECONDARY WOOD INDUSTRY SEGMENT

Secondary wood industry firms in West Virginia are those firms engaged in the remanufacture of lumber, plywood, veneer, paper, and other wood products into finished goods for consumer use. The *1984 West Virginia Forest Industry Directory* lists 140 such firms manufacturing a wide variety of wood products from kitchen cabinets to hot tubs and paper bags. However, the majority of the state's secondary wood-using industries are small, employ relatively few workers, and serve limited markets. In fact, only 47 secondary wood industry firms employ 20 or more workers [4, 14].

Historically, West Virginia has been a lumber-producing state rather than a wood product manufacturing state. Basically, secondary wood manufacturing activity in the state is not as diversified nor as extensive as it should be, considering the availability of raw materials, the size of the state's primary wood industry, and the proximity to major metropolitan markets. Evidence of this is that in 1981 West Virginia was ranked 25th among all states in volume of timber harvested but only 39th in value added by manufacture of wood products [3]. This indicates that the full value of the state's timber resource, as well as potential employment opportunities, are not being realized due to the present size and structure of West Virginia's wood products industry.

The 1982 Census of Manufactures reported statistics for 81 secondary wood industry firms.[13] They shipped approximately $198.1 million worth of products while paying $113.9 million for materials. In addition, approximately $85.2 million of value was added through the manufacture of secondary wood products such as furniture, wood containers, and paper products. The census also reported that the secondary wood industry segment employed about 2,700 workers and had an annual payroll of $37.8 million.

However, because the census does not generally canvass wood products firms with less than five employees, it may be more accurate to again adopt an activity-oriented approach. Table 9 has been compiled from several sources in order to provide the most accurate accounting of the state's secondary wood industry. Figures in this table provide information on an additional number of firms with a substantially larger work force.

Most of these firms are small, with 38 percent employing less than ten people. Only 12 firms had a work force greater than 100 people; however, they accounted for 60 percent of secondary wood industry employment [6]. The typical small size of the state's secondary wood-using establishments is a major economic disadvantage. Small firms lack the resources to be competitive in product marketing and often cannot acquire the capital to finance needed expansion.

Secondary wood-using firms are found in 42 of the state's counties, but only Randolph and Upshur have more than ten firms. Even in these counties there is no concentration of secondary wood industry firms. Resulting from this, or perhaps contributing to it, is the lack of a skilled and experienced wood manufacturing labor force. Although the state's people are familiar with forest utilization activities, there has been little opportunity to acquire the skills necessary to manufacture furniture and other high value wood products in today's modern facilities. The concentration of such a labor force in strategic areas throughout the state would certainly be attractive to new enterprises that may be considering business locations in West Virginia. (The furniture makers of the High Point, North Carolina, area would be an example.)

Unlike the primary wood industry, secondary wood industry location tends to be market-oriented rather than resource-oriented. Because of this, secondary establishments prefer to locate closer to consumer markets or major transportation arteries. In the past, West Virginia's lack of major interstate highways helped suppress establishment of secondary manufacturing industries. Instead, these businesses chose to locate in neighboring states. However, West Virginia's strategic location relative to eastern and midwestern markets, and its completion of major highway corridors should help alleviate this situation.

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[13] Included are firms which manufacture furniture from non-wood materials.

By definition, the secondary wood products industry uses wood that has already undergone some form of processing. For the most part, West Virginia's primary wood industry can supply all of the needed material input for secondary manufacturing. An additional requirement for most solid wood product manufacturing, however, is that lumber be dried prior to use in order to avoid splitting, shrinkage, or some other defect in the final product. Experts agree that "drying is a necessary intermediate step between primary conversion of logs into lumber and secondary manufacture of wood products" [1].

In 1982, West Virginia's lumber production was estimated to be between 250-300 MMBF—most of which was exported green or air-dried to other states. Only 61.2 MMBF of lumber was kiln dried in the state. This is approximately 21–24 percent of total lumber production—well below the national average of 65 percent. In 1983, only 27 firms were operating dry kilns in the state, with the greatest concentration found in Randolph County. This low level of kiln drying activity is seen as an obstacle to the development of medium-sized secondary processing plants and is an "indication of the weakness of West Virginia's secondary manufacturing industry" [1].

The majority of West Virginia's secondary wood industry firms manufacture more than a single product. This is especially true in S.I.C. groups 24 and 25 where horizontal and vertical integration is not only possible but economically beneficial. In fact, almost all firms engaged in the manufacture of millwork, wood pallets and skids, boxes and wood containers, structural wood members, and wood preserving are associated with a sawmill operation. Integration with a primary industry assures secondary manufacturers of material input that meets production specifications for their products. And by manufacturing several products, the firm strengthens its ability to profit in a competitive and fluctuating market. Some of the larger firms not only manufacture primary and intermediate wood products but have combined these activities with the manufacture of wood furniture and other finished products.

Table 9

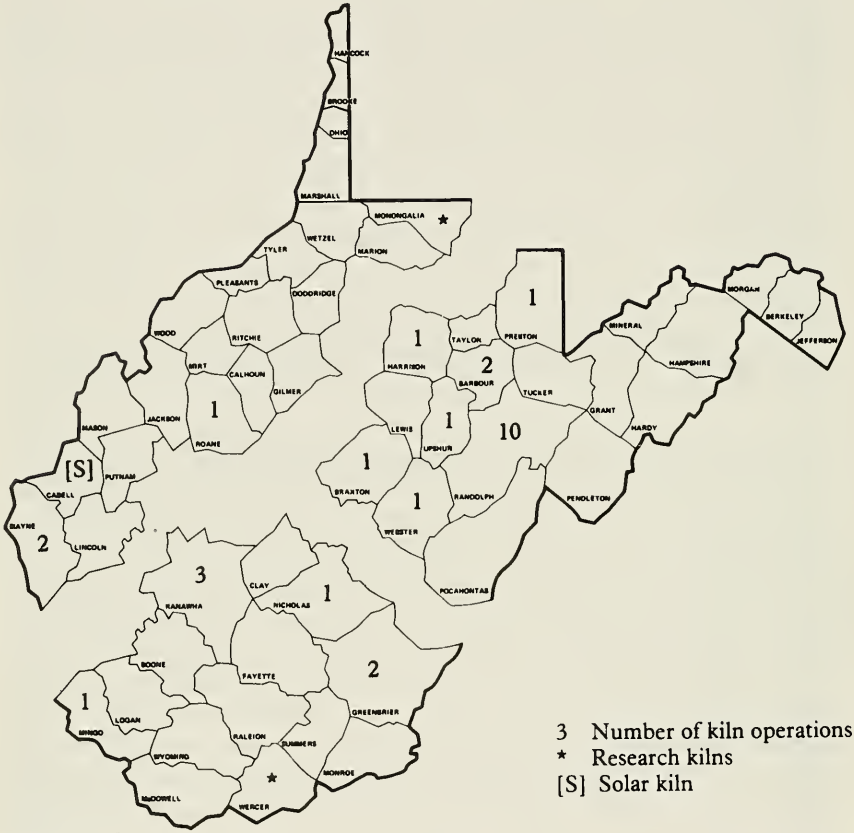
Number of firms, employees, and annual payroll for selected secondary wood products industries in West Virginia, 1982

S.I.C.	Industry title	No. of firms	No. of employees	Annual payroll	No. of firms with 20 or more employees
				($1,000)	
2431	Millwork	7	58	740	1
2434	Wood kitchen cabinets	10	194	2,475*	1
2439	Structural wood members, n.e.c.	2	14	179*	0
2441	Wood boxes	2	51	520	2
2448	Wood pallets and skids	17	179	1,825	4
2449	Wood containers, n.e.c.	2	134	1,366	2
2452	Prefabricated wood buildings	6	347	6,733	2
2491	Wood preserving	7	567	7,607	4
2499	Wood products, n.e.c.	11	109	1,110	1
	Subtotal Group 24	64	1,653	22,555	17
2511	Wood household furniture	7	180	1,365	1
2512	Upholstered wood household furniture	3	130	1,289	2
2517	Wood TV & radio cabinets	2	138	1,368	2
2519	Household furniture, n.e.c.	2	92	912	1
2521	Wood office furniture	3	50	540*	1
2541	Wood partitions & fixtures	5	52	549	1
	Subtotal Group 25	22	642	6,023	8
2642	Envelopes	1	147	1,999	1
2643	Bags, except textile bags	4	219	3,980	3
2649	Converted paper products, n.e.c.	4	446	6,067	3
2651	Folding paperboard boxes	1	80	1,173*	1
2652	Set-up paperboard boxes	1	37	543*	1
2653	Corrogated and solid fiber boxes	7	421	6,173*	5
2654	Sanitary food containers	1	939	13,768*	1
2655	Fiber cans, tubes, drums, and similar products	1	56	821*	1
	Subtotal Group 26	20	2,345	34,524	16
Total	Secondary Wood Manufacturers	106	4,640	63,102	41

* Estimated on basis of average payroll for respective 2-digit S.I.C. code.

Source: [4, 14, 15].

Figure 5. Location and number of kiln drying facilities in West Virginia, by county, 1983.



Source: [1].

MAJOR PRODUCTS

(S.I.C. Group 24)

Millwork

Many sawmills, secondary manufacturers, and retail lumber yards have integrated millwork into their operations. Presently, however, there are only seven firms whose principal product is millwork. They had an employment of 58 workers and an annual payroll of $740,000 in 1982. Only one firm employed more than 20 people [4, 14]. In 1963, millwork was the major product manufactured by 20 wood-using firms. The industry then employed 317 workers and consumed 14.7 MMBF of lumber, principally hardwoods [5]. Because so much millwork is done in conjunction with other wood manufacturing, it is difficult to determine if any real changes have occurred in the millwork industry.

Wood Kitchen Cabinets

In 1982, a total of 25 firms were manufacturing cabinets in West Virginia. Ten reported kitchen cabinet-making as their principal business activity; they employed about 194 workers and paid approximately $2.47 million in wages and salaries [4, 14]. The cabinet industry uses mostly kiln-dried, high-quality lumber and dimension parts, but some panel products with vinyl and veneer finishes are also used. Although the number of firms and reported employment were greater in 1963, cabinet manufacturing is still an important secondary wood industry in the state.

Pallets

The pallet industry, which began in the early 1940s, has grown to approximately 45 firms including 17 principal manufacturers and several integrated sawmills. The principal producers employ about 179 workers and have an annual payroll of $1.82 million [4, 14]. The pallet industry utilizes low-grade, rough and green hardwood lumber; consequently, pallets cost little to produce and are sold at low profit margins. Although some pallets are marketed to the heavy industrial region along the upper Ohio River Valley, most are sold within the state, generally within a 100-mile radius of the plant site. Major consumers of wood pallets in West Virginia include the wholesale grocery industry and the brick and block industry. The wood pallet industry was thought to have considerable growth potential back in the 1960s, but in West Virginia it has remained about the same over the last two decades.

Prefabricated Wood Buildings

This relatively new industry, developed during the 1970s, is an important segment of West Virginia's secondary wood industry. In 1982, six firms manufactured wood buildings, sections, and panels. They employed about 347 workers, with an annual payroll of $6.7 million [4, 14]. Already this new industry has become the second largest employer among secondary industries in S.I.C. groups 24 and 25.

Wood Preserving

According to the S.I.C., the wood-preserving industry includes only those establishments primarily engaged in treating wood sawed or planed in other establishments and the cutting, treating, and selling of poles, posts, and pilings [15]. In West Virginia, seven firms were engaged primarily in wood-preserving activities in 1982. They employed 567 workers, with four establishments employing more than 20 people each. The industry was also the single largest employer among secondary wood-using establishments in S.I.C. groups 24 and 25, with an annual payroll of $7.6 million in 1982—the second largest payroll of any secondary wood-using industry. Treating lumber and other wood products with preservatives added 64 cents in value for every dollar spent on materials in 1977, and should continue to provide a means for many wood-using firms to succesfully produce a higher value product.

(S.I.C. Group 25)
Wood Furniture

Most wood furniture manufacture requires an exacting input of high-quality, pre-dried, lumber; and even though West Virginia has traditionally been a major source of fine hardwood lumber, the state has not had a well-developed furniture manufacturing industry. Potential for furniture manufacturing is revealed through the fact that in a 12-month period in 1982–83, West Virginia exported 117 MMBF of furniture lumber and ranked as the fourth largest supplier to the North Carolina furniture industry [9].

West Virginia's own furniture industry was composed of only 22 manufacturers, eight of which employed more than 20 workers. This total included eleven wood household furniture manufacturers, three upholstered wood household furniture makers, and eight institutional wood furniture establishments (wood office furniture and partitions). The 22 businesses employed 642 people and had an annual payroll of more than $6.0 million [4, 14].

Previous studies of the state's wood furniture industry cited the lack of a skilled woodworking labor force as the largest barrier to establishment and further expansion of the industry within the state [2]. Other problems hindering further development are: an unreliable source of high-grade, pre-dried lumber, poor access to and knowledge of regional markets, and an almost non-existent advertising campaign [2]. Statistically, the industry is no better off than it was in 1963, and unless a concerted effort is made towards alleviating these problems, the most probable result will be the continued stagnation of West Virginia's furniture industry.

(S.I.C. Group 26)
Allied Paper Products

Despite the fact that there are no primary paper manufacturers in West Virginia, the manufacture of secondary paper products is the largest and most valuable segment of the state's secondary wood products industry. The industry also represents one of the most promising wood-using industrial segments for new growth and expansion. Unlike the other secondary wood industries in the state, which are characterized by a large number of small establishments, the secondary paper products industry consists of mostly medium to large individual businesses. In fact, 80 percent of the firms in this industry employ more than 20 workers with several having a work force of more than 100.

In 1982, 20 firms were involved in secondary paper product manufacturing with a total employment of 2,345—50 percent of total secondary wood industry employment (Table 9). The industry's annual payroll exceeded $34.5 million, representing almost 55 percent of all secondary wood manufacturing payrolls.

According to the 1982 Census of Manufactures, secondary paper processing also had the highest wages paid in the state's entire wood products industry—averaging $16,077 per employee. The paper products industry shipped more than $109.6 million worth of paper products and added $46.8 million in product value [15].

Among the individual paper product segments, the manufacture of bags (except textile bags), corrugated and solid fiber boxes, and sanitary food containers are the most important—accounting for 60 percent of the firms, 67 percent of the work force, and 69 percent of the payroll. In 1982, the state's lone manufacturer of sanitary food containers accounted for 38 percent of paper products industry employment and almost 40 percent of its payroll.

It is estimated that by the year 2000, the demand for paper products will double over 1976 levels and continue to grow through the year 2030 [10]. The state is well situated relative to raw paper sources and consumer markets to allow for continued in-state predominance of the allied paper products industry and should also provide additional opportunities for expansion.

RECENT TRENDS IN WEST VIRGINIA'S WOOD PRODUCTS INDUSTRIES

Figures from the 1982 Census of Manufactures reveal a substantial decline in West Virginia's wood products economy since the early 1970s. This decline extended to practically every segment of the wood industry, and resulted in the loss of approximately 2,400 jobs and the closing of more than 100 wood-based establishments. By 1982, the value of shipments from the wood industry had fallen more than 23 percent, in constant 1982 dollars, over the past ten years. This contributed to a nearly 35 percent drop in value added through the manufacture of wood products over the same period (Table 10).

During the mid-1970s, the state's wood industries were gradually weakening in their struggle to maintain their level of economic performance. The severe recession in the early 1980s accentuated the decline and depressed the wood industry to its lowest levels in several decades (Figure 6). Since 1972, expenditures in constant dollars for new capital investments declined 48 percent. This low level of capital spending could hinder or postpone any post-recession recovery in West Virginia's wood industry.

The fact that the census year 1982 occurred during a nationwide recession offers some hope that the poor performance of the wood industry may, in part, be explained by the recession and that the value of wood product shipments will rebound as the US economy gains momentum. In fact, there were a few segments of the state's wood industry that managed to maintain their position in selected economic measures despite the overall poor performance of the wood industry from 1972 to 1982.

Further analysis of these trends is facilitated by a more in-depth examination of individual economic measure such as employment and payroll, value of shipments, and value added. These measures are reported in the Census of Manufactures and have been adjusted for the general price inflation that occurred from 1972-1982—expressed in constant 1982 dollars.

Table 10

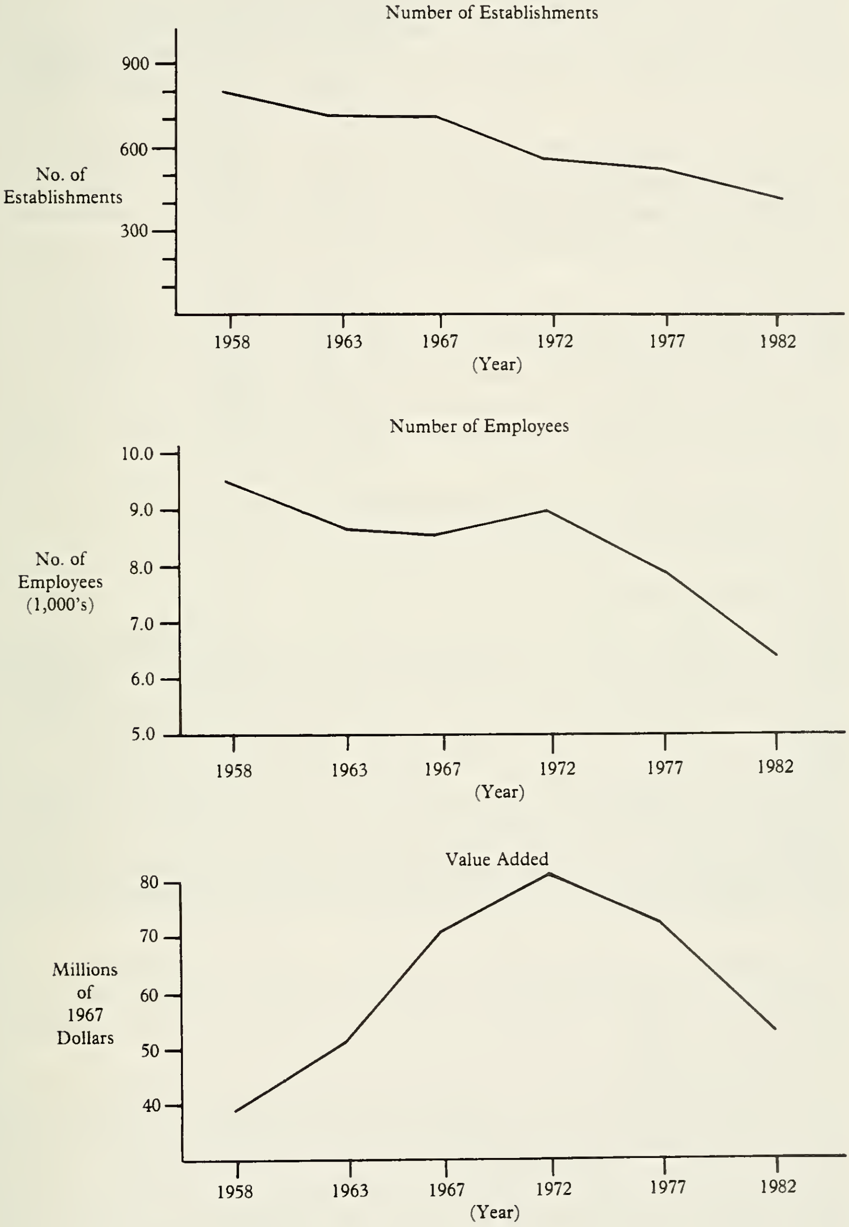
Recent trends in West Virginia wood product industries, 1972-1982

	Percent change* 1972-1977	Percent change** 1977-1982	Percent change** 1972-1982
Number of establishments	-4.33	-17.74	-21.30
Number of employees	-11.36	-17.98	-27.27
Annual payroll†	-10.26	-24.37	32.33
Cost of materials††	+0.51	-11.40	-11.04
Value of shipments††	-7.10	-17.61	-23.54
Value added††	-12.95	-25.17	-34.94
New capital expenditures††	NA	NA	-48.05

*Constant 1977 dollars.
**Constant 1982 dollars.
†Adjusted using the Consumer's Price Index.
††Adjusted using the Producer's Price Index.

Source: US Bureau of the Census, *Census of Maunfacturers 1972, 1977, and 1982.*

Figure 6. Trends in the number of establishments, employment, and value added for wood product industries in West Virginia, 1958–1982.



Source: US Census of Manufacturers 1958–82.

Table 11
Value of shipments for selected West Virginia wood products manufacturers, 1972 and 1982

	(millions of 1982 dollars)		
Type of shipment	1972†	1982	Percent change 1972–1982
Lumber and wood products (S.I.C. 24)	304.32	212.0	-30.34
Logging camps and contractors (2411)	34.68	37.1	+6.98
Sawmills and planing mills (242)	174.90	101.9	-41.74
Millwork, veneer, and structural members (243)	55.79	28.3	-49.27
Furniture and fixtures (25)	61.32	60.2	-1.83
Paper and allied products (26)	133.69	109.6	-18.02
Paperboard container and boxes (265)	56.29	48.0	-14.73
Total, Groups 24, 25, 26	499.33	381.80	-23.54

†Inflated using the Producer's Price Index for all commodities.

Source: US Bureau of the Census, *Census of Manufacturers 1972, 1977, and 1982.*

Value of Shipments

After eliminating the effects of inflation, the value of shipments from West Virginia's wood product manufacturers declined 23.5 percent from 1972–1982 (Table 10). After a slight decrease of 7.1 percent from 1972–1977, the value of shipments dropped more dramatically from 1977–1982—an additional 17.6 percent.

Despite the substantial decline overall, the furniture and fixtures segment managed to minimize its loss of shipment values to less than 2 percent. This is in contrast to a 30.3 percent drop in lumber and wood product shipment values and an 18.0 percent loss in the value of allied paper product shipments (Table 11).

The greatest increase in value of shipments over the ten-year period was recorded by the logging camps and contractors segment, which showed a 7.0 percent gain, despite substantial declines in timber harvest volumes throughout the 1970s.

Sawmills and planing mills, meanwhile, saw their value of shipments fall 41.7 percent, while shipment values in firms manufacturing millwork, veneer, and structural wood members dropped 49.3 percent. During this ten-year period, the price of lumber (which accounted for 29 percent of all wood product shipment values in 1977) increased at a slower rate than the prices in the general economy; thus the constant dollar decrease in the value of shipments reflects a decrease in the real economic value of lumber as well as any decrease in the physical volume of shipments.

This is not true for the paper and allied products industry which experienced a more moderate drop in shipment values. In general, prices for paper products increased about the same as all commodities, meaning that the drop in shipment value was a direct result of a decreasing physical volume of output. Hopefully, given the incentive of higher relative prices for paper products, it should not be difficult for the state's paper products industries to recover from this moderate slump.

Cost of Materials

There was a slight decline in the overall cost of materials purchased by West Virginia's wood industry over the ten-year period. Material costs remained constant from 1972–1977, but declined 11.4 percent from 1977–1982, for a net decrease of 11.0 percent (Table 12).

There also was a marked variation in material cost trends among individual wood industry segments. Although material costs for the lumber and wood products segment declined 19.5 percent, the furniture and fixtures industry incurred a substantial 15.8 percent increase. The allied paper products industry, meanwhile, experienced a slight drop in its cost of materials—5.0 percent during the ten-year period.

Raw material costs were also found to vary among industries within the same S.I.C. group. For instance, logging camps and contractors were faced with a 16 percent increase while both sawmills and millworking establishments experienced considerable reductions. The reductions in the sawmill and millworking industries probably resulted from lower material purchases brought on by the depressed wood products market during the recent recession.

In the case of logging camps and contractors, however, higher material costs can be explained by the fact that almost all material costs incurred by logging contractors are derived from purchases of timber stumpage. Since timber harvests were declining over this time period, the increase in costs for loggers represented real increases in the price of timber stumpage. Logging contractors were able to pass most of this increase in costs on to log buyers, as reflected in their real increase in value of shipments despite their lower physical output.

Table 12
Cost of materials for selected West Virginia wood products manufacturers, 1972 and 1982

Manufacturers	(millions of 1982 dollars)		Percent change
	1972†	1982	1972–1982
Lumber and Wood Products (S.I.C. 24)	152.29	122.6	-19.50
Logging camps and contractors (2411)	18.09	21.0	+16.09
Sawmills and planing mills (242)	86.95	60.6	-30.30
Millwork, veneer, and structural members (243)	25.38	13.4	-47.20
Furniture and fixtures (25)	33.42	38.7	+15.80
Paper and allied products (26)	65.09	61.8	-5.05
Paperboard containers and boxes (265)	28.90	30.4	+5.19
Total, Groups 24, 25, 26	250.80	223.1	-11.04

†Inflated using the Producer's Price Index for all commodities.

Source: US Bureau of the Census, *Census of Manufacturers 1972, 1977, and 1982.*

Table 13

Value added by selected West Virginia wood products manufacturers, 1972 and 1982

Manufacturers	(millions of 1982 dollars)		Percent change
	1972†	1982	1972–1982
Lumber and Wood Products (S.I.C. 24)	150.28	91.1	-39.38
Logging camps and contractors (2411)	15.83	15.9	+.44
Sawmills and planing mills (242)	84.19	42.2	-49.89
Millwork, veneer, and structural members (243)	33.17	15.9	-52.07
Furniture and fixtures (25)	27.39	22.5	-17.85
Paper and allied products (26)	68.86	46.8	-32.04
Paperboard containers and boxes (265)	27.14	17.0	-37.36
Total, Groups 24, 25, 26	246.53	160.4	-34.94

†Inflated using the Producer's Price Index for all commodities.

Source: US Bureau of the Census, *Census of Manufacturers 1972, 1977, and 1982.*

Value Added

Basically, value added in manufacturing is the difference between an industry's value of shipments and its cost of materials. It represents revenue available to cover additional operating expenses such as payroll, rent, capital investment and depreciation, taxes, and profits. The sum of all value added in a country's economy represents gross national product (GNP).

Since 1972, overall value added fell by 35 percent for West Virginia wood product manufacturers (Table 13). Reductions in value added occurred in every major segment in the state's wood industry except logging camps and contractors. For instance, after adjustment for inflation and despite a 24 percent reduction in cost of materials, sawmills and planing mills still sustained a 50.0 percent loss of value added. In the lumber and wood products segment as a whole, value added declined 39.4 percent. Meanwhile, the paper and allied products segment suffered a 32.0 percent loss and the furniture and fixtures industry experienced a more moderate decline of 17.8 percent. This represents a serious loss of operating revenue and profits to the state's wood industry.

Total value added in these industries declined by a greater percentage then did their total value of shipments; consequently, the value added per dollar of shipments for the wood industry fell from 49 cents in 1972 to 42 cents in 1982. The relationship between value of shipments and cost of materials also changed. By 1982, the wood industry's value of shipments per dollar cost of materials had decreased form $1.99 in 1972 to $1.71. This meant that the cost of materials expressed as a percentage of the wood industry's total value of shipments rose from 50 percent to 58 percent over the ten-year period.

The only segment of the wood products industry to avoid a real decrease in value added between 1972 and 1982 was logging camps and contractors. Probably because of the increased economic value of sawtimber and increased operating efficiency, loggers were able to maintain their margin of value added by manufacture.

Employment and Payrolls

Employment in West Virginia's wood products industries declined 27.3 percent over the ten-year period, representing a loss of 2,400 jobs. This loss was reflected in a 33.3 percent reduction in the size of wood industry's payroll, in constant 1982 dollars. Again, these declines were evident in every segment of the wood industry except logging camps and contractors, where payrolls declined slightly while employment remained constant (Tables 14 and 15).

The lumber and wood products industry (S.I.C. 24) sustained a 30 percent decline in its work force—losing some 1,800 employees by 1982. This decline was already evident prior to 1977; the recession only accelerated it.

This was also true of the entire wood industry's payroll. In 1982, West Virginia's wood industry was not only employing fewer people but was paying them lower real wages than ten years earlier. The average wood industry worker earned $11,969 in 1982—down 6.9 percent from 1972. Logging camps and contractors paid the lowest wages in the wood industry, which apparently helped them attain real gains in other economic measures. The highest annual wages were found in the paper and allied products industry where workers manufacturing paperboard containers earned $19,800—up 7.1 percent since 1972 (Table 16).

Generally, wood industry payrolls comprised a slightly smaller share of value added in 1982 than in 1972. Payrolls accounted for 50 percent of value added in 1972 as compared to 48 percent in 1982. Thus, even while the industry's work force and payrolls were declining, its value added and productivity were declining as well. This virtually eliminated any advantage in payroll cost reductions. This would also seem to indicate that workers were not being eliminated because of increased plant efficiency, but because of cutbacks and plant closings brought on by a weak wood products industry facing poor economic conditions. This is supported by the fact that value added per employee dropped 3.7 percent during the ten-year period—from $25,751 to $24,796 in constant 1982 dollars.

Table 14
Employment in selected West Virginia wood products manufacturers, 1972 and 1982

Manufacturers	(thousands of employees) 1972	1982	Percent change 1972–1982
Lumber and Wood Products (24)	6.0	4.2	-30.00
Logging camps and contractors (2411)	.8	.8	0.0
Sawmills and planing mills (242)	3.0	2.2	-26.67
Millwork, veneer, and structural members (243)	1.5	.5	-66.67
Furniture and fixtures (25)	1.1	.9	-18.18
Paper and allied products (26)	1.7	1.3	-23.53
Paperboard containers and boxes (265)	.7	.5	-28.57
Total, Groups 24, 25, 26	8.8	6.4	-27.27

Source: US Bureau of the Census, *Census of Manufacturers 1972, 1977, and 1982.*

Table 15

Payrolls for selected West Virginia wood products manufacturers, 1972 and 1982

Manufacturers	(millions of 1982 dollars) 1972	1982	Percent change 1972–1982
Lumber and Wood Products (S.I.C. 24)	71.38	45.00	-36.96
Logging camps and contractors (2411)	8.09	7.70	-4.76
Sawmills and planing mills (242)	36.73	22.20	-39.56
Millwork, veneer, and structural members (243)	16.40	6.20	-62.20
Furniture and fixtures (25)	13.40	10.70	-20.15
Paper and allied products (26)	28.41	20.90	-26.44
Paperboard containers and boxes (265)	12.94	9.90	-23.47
Total, Groups 24, 25, 26	113.19	76.60	-32.33

Source: US Bureau of the Census, *Census of Manufacturers 1972, 1977, and 1982.*

Table 16

Average annual payroll per employee for selected wood products manufacturers, 1972 and 1982

Manufacturers	(millions of 1982 dollars) 1972	1982	Percent change 1972–1982
Lumber and Wood Products (S.I.C. 24)	11,896	10,714	-9.94
Logging camps and contractors (2411)	10,106	9,625	-4.76
Sawmills and planing mills (242)	12,243	10,091	-17.58
Millwork, veneer, and structural members (243)	10,933	12,400	+13.42
Furniture and fixtures (25)	12,181	11,889	-2.40
Paper and allied products (26)	16,713	16,077	-3.81
Paperboard containers and boxes (265)	18,480	19,800	+7.14
Weighted average, Groups 24, 25, 26	12,862	11,969	-6.94

Source: US Bureau of the Census, *Census of Manufacturers 1972, 1977, and 1982.*

DISCUSSION OF INDUSTRY TRENDS

It is not easy to explain the decline in West Virginia's wood industries, especially in light of the tremendous advantage and potential associated with the state's forest resource. It would be simple to contend that 1982 was a recession year and that the census data were not representative of the ten-year period, but most of the previously discussed economic measures indicate that a decline was occurring in the state's wood industry prior to 1977. The severe recession of 1980–82 only served to reinforce this downward trend.

During this period, stumpage prices were rising in real terms while the prices for lumber and other wood products were falling behind the rate of inflation. From 1972–1977, the wood industry's cost of materials was remaining constant, while its value of shipments was declining, thus eroding the industry's value added through manufacture. The 34.9 percent reduction in value added over the ten-year period decreased revenues available for rent, taxes, interest, payrolls, and not least, profits. During this time the industry's new capital expenditures fell 48.0 percent as a result of this squeeze on discretionary revenue (Table 17).

Although these negative trends also were found in the wood products industry outside the state, the consequences of these conditions probably fell more heavily on West Virginia because of the small, segmented, and undiversified nature of its wood industry. Recall that lumber and wood products manufacturing (S.I.C. 24) dominates the state's wood-based industires, accounting for 66 percent of wood industry employment, 56 percent of its value of shipments, and 56 percent of its value added. From 1972–1982, the industry was faced with rising real costs for stumpage and other materials while the price of lumber and other wood products was not keeping up with inflation. Thus, the wood products industry had no real price incentive to market its products; the only exception was the paper and allied paper products industry.

The inability of West Virginia's wood product manufacturers to compete under these adverse economic conditions stems from the small size, lack of integration, and undiversified product line of the typical West Virginia wood manufacturing establishment. It was these structural characteristics, combined with a poor economy, that forced many wood-using firms to reduce operations or shut down unprofitable mills.

Table 17

New capital expenditures by selected West Virgina wood products manufacturers, 1972 and 1982

Manufacturers	(millions of 1982 dollars)		Percent change
	1972*	1982	1972–1982
Lumber and Wood Products (24)	15.08	5.90	-60.88
Logging camps and contractors (2411)	1.66	2.00	+20.48
Sawmills and planing mills (242)	10.30	2.30	-77.67
Millwork, veneer, and structural members (243)	1.76	.40	-77.27
Furniture and fixtures (25)	1.01	.50	-50.50
Paper and allied products (26)	2.01	3.00	+49.25
Paperboard containers and boxes (265)	.75	(D)	NA
Total, Groups 24, 25, 26	18.90	9.40	-48.04

*Inflated using the Producer's Price Index for all commodities.

(D)—Not available due to disclosure laws.

NA—Not available.

Source: US Bureau of the Census, *Census of Manufacturers, 1972 and 1982.*

SUMMARY AND COMMENTS

In 1982, the state's wood product industries shipped $381.8 million worth of wood and paper products and added $160.4 million in value through manufacture. These wood-based industries employed approximately 6,400 workers and paid about $76.6 million dollars in wages and salaries. Expenditures for new capital investments amounted to only $9.4 million in 1982.

Primary conversion industries dominate wood-based manufacturing in West Virginia, accounting for 77 percent of wood product manufacturing plants and more than half of the wood industry's labor force. The primary segment contributes 48 percent of the wood industry's value of shipments, 51 percent of its payroll, and 47 percent of its value added through manufacture. It is evident then, that the majority of the wood-based industry's resources account for only about half of its economic output.

In contrast, the 56 firms that manufacture secondary solid wood products account for 24 percent of the industry's value added, as compared to the 47 percent attributed to the 355 firms in the state's primary industries. Even more impressive is the contribution of the allied paper products segment (S.I.C. 26). These 25 firms account for the remaining 29 percent of the wood industry's value added through manufacture.

Overall, the amount of value added generated by the state's wood industry is relatively low. This is a direct result of the low level of secondary wood manufacturing occurring in the state. Lumber is the state's major product, but most of West Virginia's production is used or exported with little manufacture after primary conversion. Little of the state's lumber is kiln dried, and most secondary manufacturing in S.I.C. group 24 (lumber and wood products) adds little value to the final products.

The typical sawmill in West Virginia is small and inefficient. As a consequence, most sawmills lack the financial resources to invest in the latest technology and equipment. Low-value products such as mine timbers or disposable pallets are sometimes manufactured from quality logs and lumber because the mill owners do not have the knowledge and equipment required to manufacture grade lumber, furniture blanks and similar high-value products. Nor do they have the knowledge of regional markets to capitalize on the demand for these products.

Even if improvements were made in the efficiency of West Virginia's sawmills, the full value of the state's timber resources would still not be realized due to the limited manufacturing of secondary wood products. Secondary manufacturing is the weak link in the state's forest-based industry. By failing to manufacture finished wood products in the state, West Virginia is forfeiting not only added product value, but jobs, personal income, and tax revenue as well.

Because of the small size and fragmented structure of the state's wood industry and the scarcity of investment and operating capital, it will be difficult for West Virginia's wood industry to recover quickly from the declines observed from 1972–1982. Also, it is unlikely that the wood products industry can fully capitalize on the state's improved forest resource base unless progressive and coordinated efforts are made by both public and private concerns to improve the structure, competitiveness, and marketing power of West Virginia's wood-based industries.

The present structure of the state's wood-based industry, which is heavily skewed towards primary manufacturing, is denying the realization of the economic potential present in its forest resources. The present weakness is considerable and will require a dedicated, long-term program targeted at promoting development and expansion of the secondary wood products industry.

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APPENDIX A

Table A1

Primary and secondary industries in West Virginia, by standard industrial classification (S.I.C.) and description.

Primary Manufacturing

Logging camps and logging contractors:

2411 *Logging Camps and Logging Contractors*—Establishments primarily engaged in cutting timber and producing rough, round, hewn, or riven primary forest or wood raw materials. Independent contractors engaged in estimating or trucking timber, but who perform no cutting operations, are classified in nonmanufacturing industries. Logging and woods operations conducted in combination with sawmills, pulpmills, or other converting establishments, and not separately reported, are classified in their respective industry groups.

Sawmills and planing mills:

2421 *Sawmills and Planing Mills, General*—Establishments primarily engaged in sawing rough lumber and timber from logs and bolts or resawing cants and flitches into lumber, including box lumber and softwood cut stock; planing mills combined with sawmills; and separately operated planing mills which are engaged primarily in producing surfaced lumber and standard workings or patterns of lumber. Includes establishment primarily engaged in sawing lath and railroad ties, and in producing tobacco hoghead stock, wood chips, and snow fence lath.

2426 *Hardwood Dimension and Flooring*—Establishments primarily engaged in manufacturing hardwood dimension lumber and working therefrom: and other hardwood dimension, semifabricated or ready for assembly; hardwood flooring; and wood frames for household furniture. Establishments primarily engaged in manufacturing wood frames for household furniture, added to this S.I.C. in 1972, were classified in industry 2512, Upholstered Household Furniture, in 1967 and 1963.

2429 *Special Product Sawmills, n.e.c.*—Establishments primarily engaged in manufacturing excelsior, wood shingles, and cooperage stock, and in special products, not elsewhere classified.

Veneer and plywood plants:

2435 *Hardwood Veneer and Plywood*—Establishments primarily engaged in producing commercial hardwood veneer, either face or technical, and those primarily engaged in manufacturing commercial plywood or prefinished hardwood plywood. This includes nonwood faced plywood from veneer produced in the same establishment or from purchased veneer. This S.I.C. was created in 1972 when former S.I.C. 2432, Veneer and Plywood, was split into separate hardwood and softwood industries.

Pulp, paper, and paperboard mills:

2631 *Paperboard Mills*—Establishments primarily engaged in manufacturing paperboard, including paperboard coated on the paperboard machine, from woodpulp, waste paper, and other fibers; and which may also manufacture converted paperboard paperboard products. Pulpmills combined with paperboard mills and not separately reported are also included.

Other primary:

2861 *Gum and Wood Chemicals*—Establishments primarily engaged in manufacturing hardwood and softwood distillation products, wood and gum naval stores, charcoal, natural dyestuffs, and natural tanning materials.

Secondary Manufacturing

Millwork and prefabricated wood products:

2431 *Millwork*—Establishments primarily engaged in manufacturing fabricated millwork. Planing mills primarily engaged in producing millwork are included, but planing mills primarily producing standard working or patterns of lumber are classified in S.I.C. 2421, Sawmills and Planing Mills, General. In 1967 and 1963, this S.I.C. also included the manufacture of custom cabinetwork to be built-in, which was transferred to new S.I.C. 2434, Wood Kitchen Cabinets, in 1972.

2434 *Wood Kitchen Cabinets*—Establishments primarily engaged in manufacturing wood kitchen cabinets, stock line or custom, and vanities and other cabinetwork. This S.I.C. was created in 1972 by combining the manufacture of custom cabinetwork to be built-in from former S.I.C. 2431 with wood kitchen cabinets from former S.I.C. 2511.

2439 *Structural Wood Members, n.e.c.*—Establishments primarily engaged in producing laminated or fabricated trusses, arches, and other structural members of lumber. This S.I.C. was created in 1972. Establishments now classified in this S.I.C. were in S.I.C. 2433, Prefabricated Wood Structures, in 1967 and 1963.

2452 *Prefabricated Wood Buildings*—Establishments primarily engaged in manufacturing prefabricated wood buildings, sections, and panels. This S.I.C. was created in 1972. Establishments now classified in this S.I.C. were formerly in S.I.C. 2433, Prefabricated Wood Structures.

Wooden containers:

2441 *Nailed Wood Boxes and Shook*—Establishments primarily engaged in manufacturing nailed and lock-corner wooden boxes (lumber or plywood), which also may produce shook for nailed and lock-corner boxes.

2448 *Wood Pallets and Skids*—Establishments primarily engaged in manufacturing wood and wood-metal combination pallets and skids. This S.I.C. was created in 1972. Establishments classified in this S.I.C. were formerly in S.I.C. 2499, Wood Products, n.e.c.

2449 *Wood Containers, n.e.c.*—Establishments primarily engaged in manufacturing wood containers, not elsewhere classified, such as cooperage, wirebound boxes and crates, and other veneer and plywood containers. This S.I.C. was created in 1972 by combining former S.I.C.'s 2442, Wirebound Boxes and Crates; 2443, Veneer and Plywood Containers; and 2445, Cooperage.

Furniture:

2511 *Wood Household Furniture*—Establishments primarily engaged in manufacturing wood household furniture commonly used in dwellings. Also included are establishments engaged in manufacturing infants' and childrens' wood furniture and wood outdoor furniture. In 1967 and 1963, this S.I.C. also included establishments primarily engaged in the manufacture of wood kitchen cabinets (transferred to S.I.C. 2434 in 1972) and those primarily engaged in manufacturing wood, TV, radio, phonograph, and sewing machine cabinets (transferred to S.I.C. 2517 in 1972).

2512 *Upholstered Household Furniture*—Establishments primarily engaged in manufacturing upholstered furniture on wood frames. In 1963 and 1967, this S.I.C. also included those firms primarily engaged in manufacturing only wood frames for upholstered furniture. In 1972 these establishments were included in S.I.C. 2426.

2517 *Wood TV and Radio Cabinets*—Establishments primarily engaged in manufacturing wood radio, phonograph, hi-fi, and television cabinets. This S.I.C. also includes establishments primarily engaged in manufacturing sewing machine cabinets. This S.I.C. was created in 1972. Establishments now classified in this S.I.C. were formerly in 2511, Wood Household Furniture.

2519 *Household Furniture, n.e.c.*—Establishments primarily engaged in manufacturing reed, rattan, and other wicker furniture, plastics and fiberglass household furniture and cabinets, and household furniture, n.e.c.

2521 *Wood Office Furniture*—Establishments primarily engaged in manufacturing wood office furniture whether padded, upholstered, or plain.

2541 *Wood Partitions and Fixtures*—Establishments primarily engaged in manufacturing wood shelving, lockers, office and store fixtures, prefabricated plastic laminated fixture tops, and related fabricated products.

Paper and paperboard products:

2642 *Envelopes*—Establishments primarily engaged in manufacturing envelopes of any description from purchased paper and paperboard.

2643 *Bags, Except Textile Bags*—Establishments primarily engaged in manufacturing bags from purchased paper, cellophane, acetate, polyethylene, polypropylene, pliofilm, foil, and similar sheet or film materials.

2649 *Converted Paper Products, n.e.c.*—Establishments primarily engaged in manufacturing from purchased paper of paperboard, miscellaneous converted paper or paperboard products, not elsewhere classified. Includes firms manufacturing wallpaper in 1972, formally in 2644 in 1967 and 1963.

2651 *Folding Paperboard Boxes*—Establishments primarily engaged in manufacturing folding paperboard boxes from purchased paperboard.

2652 *Set-up Paperboard Boxes*—Establishments primarily engaged in manufacturing set-up paperboard boxes from purchased paperboard.

2653 *Corrugated and Solid Fiber Boxes*—Establishments primarily engaged in manufacturing corrugated and solid fiber boxes and related products from purchased paperboard of fiber stock. Important products of this industry include corrugated and solid fiberboard boxes, pads, partitions, display items, pallets, single face products, and corrugated sheets.

2654 *Sanitary Food Containers*—Establishments primarily engaged in manufacturing food containers from special food board. Important products of this industry include fluid milk containers; folding paraffined cartons for butter, margarine, and shortening; ice cream containers; frozen food containers; liquid tight containers; dishes, spoons, and similar products.

2655 *Fiber Cans, Drums, and Similar Products*—Establishments primarily engaged in manufacturing from purchased materials fiber cans, cones, drums, and similar products, with or without metal ends, and vulcanized fiber boxes.

Other secondary:

2491 *Wood Preserving*—Establishments primarily engaged in treating wood, sawed or planed in other establishments, with creosote or other preservatives to prevent decay and to protect against fire and insects. Also included is the cutting, treating, and selling of poles, posts, and piling, but establishments primarily engaged in manufacturing other wood products (which they may also treat with preservatives) are not included.

2499 *Wood Products, n.e.c.*—Establishments primarily engaged in turning and shaping wood and manufacturing miscellaneous wood products, rattan, reed, splint, straw, veneer, veneer strips, wicker, and willow. Also included are establishments manufacturing lasts and related products, cork products, hardboard, and wood or metal mirror and picture frames. In 1967 and 1963, this S.I.C. also included establishments primarily engaged in manufacturing pallets and skids.

Source: Phelps, Robert B.
Timber in the United States Economy 1963, 1967, and 1972.
United States Department of Agriculture, Forest Service.
General Technical Report WO-21. 1980.
US Government Printing Office, Washington, D.C.

Table A2

Estimated employment, and value added attributed to timber, related activities in West Virginia, 1972 and 1982.*

Activity	Estimated No. of employees	Estimated 1972 value added attributed to timber	Estimated 1982 value added attributed to timber
		(Millions of dollars)	(Millions of dollars)
Timber management	1,700	13.5	33.89
Transportation	2,150	35	87.89
Marketing	4,150	33	82.85
Retail Outlets	2,070	- - -	- - -
Total	10,070	81.5	204.57

*1982 figures for value added attributed to timber were estimated by inflating 1972 values by percent change in the producer price index 1972–1982, assuming no change in employment and timber related activities since 1972.

Source: [8].

Table A3

In the *1984 Directory of West Virginia's Forest Industries,* sawmills were classified according to annual production using the following table. Total statewide sawmill capacity was calculated by multiplying the production range by the number of mills in that size class and summing the respective capacities.

Sawmill size and production ranges in West Virginia

Mill Size (BF/yr)	Number of Mills	Production Range
100 M +	115	100 M to 499 M Board Feet per year
500 M +	42	500 M to 999 M Board Feet per year
1 MM+	41	1,000 M to 1,999 M Board Feet per year
2 MM+	37	2,000 M to 4,999 M Board Feet per year
5 MM+	20	5,000 M to 9,999 M Board Feet per year
10 MM+	4	10,000 M or more Board Feet per year
Total statewide	259	287,850 M–606,250 M Board Feet per year

APPENDIX B

Definition of Terms

Band Saw—a saw consisting of a continuous wide steel band with teeth on one or both edges. Band saws are mounted on two wheels; the lower wheel is powered, and the upper wheel is free-running. Band saws are usually associated with large sawmills [7].

Circle Saw—a circular saw of large diameter mounted on a mandrel. The log is supported on a carriage that runs on a double track situated approximately parallel to the plane of the saw blade. The log is passed through the saw resulting in the removal of a slab, board, plank, or timber, Circle saws are usually associated with small sawmills [7].

Cost of Materials—the cost of both raw and related materials (includes materials, supplies, fuel, electric energy, cost of resales, and cost of contract work) required to manufacture a product [13].

Crib Block—a wooden mine block (usually 2″x8″x2′) which is used to support the roof of a mine.

Custom Sawmills—mills which produce less than 100 thousand board feet (100 MBF) of lumber per year and/or provide custom sawing services [17].

Dimension Stock—wood pieces that have been further processed from boards using ripping and crosscutting operations to eliminate unacceptable defects, by the manufacturer before shipment [7].

Dry Kiln—a drying chamber in which green or partially dry lumber is placed and is then subjected to a sequential series of temperature and relative humidity conditions most conducive to rapid drying with a minimum of drying-induced defects [7].

Grade Lumber—lumber that has been classified on the basis of the number, size, and character of such physical features as knots, splits, checks, wormholes, wane, pitch streaks, and pockets [7].

Headsaw—any saw used to convert round logs or cants into boards, planks, or timbers. There are three basic types used in the log breakdown operation: circular headsaws, band headsaws, and gang headsaws [7].

Horizontal Integration—the diversification of a company's product mix, involving the manufacture of the same or related products in the same geographic area. For example, a lumber company with two sawmills.

Linerboard—paperboard made of long-fibered pulps, with special characteristics (is capable of bending/creasing without rupture, will provide a surface suitable for printing and for reception of adhesives, is strong enough to ensure safe delivery of merchandise, is resistant to water and grease, and is resistant to fading or discoloration in sunlight) that is used to cover the inner and outer faces of container boards [7].

Log and Bolt Mills—mills that use logs and/or bolts in the production of staves, handles, and plywood and veneer [17].

Pallet—a low, sturdy platform on which materials in process of manufacture, or finished goods, may be stacked in order to expedite their handling, movement, and storage with use of mechanical fork lifts and/or hand trucks. Although pallets are not containers in the ordinary sense, a multitude of them serve as carriers in the shipment of unitized loads of goods [7].

Paperboard—a composition board consisting of several layers of different pulp stock laid down to form a thicker sheet. Two primary divisions of paperboard are boards for containers, and boards for building and insulating uses [7].

Paperboard Mills—any establishment primarily engaged in the manufacture of paperboard (fiberboard) and heavy papers.

Planer—a machine used (following the drying operation) to manufacture lumber to more accurate dimensions, improve its surface characteristics, or impart to it a desired shape [7].

Planing Mill—those mills primarily engaged in producing surfaced lumber and standard working or patterns of lumber, and includes establishments primarily engaged in sawing lath and railroad ties [13].

Plywood—glued wood constructions built up of veneer layers so that the grain of each layer is at a right angle to that of the adjacent layer in the assembly [7].

Primary Wood Industry—those establishments actively engaged in cutting, transporting, sawing, slicing, chipping, or other initial processing of raw wood materials.

Resaw—the process of further reducing timber in the sawing operation. Resaws are usually associated with large sawmills in which the log breakdown process in accomplished in several operations. Resaws may be of either the circular or band saw type [7].

Roundwood Producers—those establishments primarily engaged in the production of logs, bolts, and other round timber generated from harvesting trees for industrial or consumer use.

Rustic Products Mills—those mills primarily engaged in the production and/or sales of rustic fencing, hardwood rails, posts, mine props, railroad ties, firewood, bark, and sawdust [17].

Scragg Saw—adjustable, twin, circular saws mounted on a mandrel. Roundwood material (usually of inferior quality) is passed between the saws to form a two-sided cant. Scragg saws are usually used as resaws in combination with band headsaws.

Secondary Wood Industry—those establishments primarily engaged in the remanufacture of lumber, plywood, veneer, paper, and other products into finished goods for consumer use.

Value Added—the conversion of the value of shipments (including resales and miscellaneous receipts) to value of production by adding the ending inventory of finished goods and work in process inventories and subtracting the beginning inventory. The cost of materials (including materials, suppplies, fuel, electric energy, cost of resales, and cost of contract work) is then subtracted from this value of production to obtain value added [13].

Value of Shipments—the net selling value of materials, components, and finished products, after discounts and allowances and excluding freight and excise taxes [13].

Vertical Integration—the diversification of a company's operations involving different stages in the production of a product. For example, a lumber manufacturer with a dry kiln operation.

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FORESTS & THE WEST VIRGINIA ECONOMY

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Bulletin 691, Forests and the West Virginia Economy

Volume 1: Forest Land Base, Forest History and Types, Forest Ownership and Inventory

Volume 2: The Timber Resource

Volume 3: The Commercial Timber Harvest in West Virginia

Volume 4: The Size and Economic Performance of West Virginia's Wood Products Industry

Key Abbreviations
S.I.C.=Standard Industrial Classification
n.e.c=Not Elsewhere Classified

Authors

Kenneth D. Jones is research technologist and Gary W. Zinn is forest scientist in the Division of Forestry, West Virginia Agricultural and Forestry Experiment Station, West Virginia University

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Agricultural and Forestry Experiment Station
College of Agriculture and Forestry
Robert H. Maxwell, Director
Morgantown

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FOREWORD

This is the fifth in a series of reports on West Virginia's forest resources. The series examines the forest resources, their current levels of utilization, their present role in the state's economy, the outlook for the future, and the prospects for increasing the economic contribution of forests and forest-based activity for the benefit of the citizens of West Virginia.

The *Forests and the West Virginia Economy* Series focuses mainly on the timber resource and the timber-based economy. Although observations on other forest resources are included, these are not examined in detail. This particular volume discusses the relative position and economic importance of the timber-based industry in the state's economy, its competitiveness with neighboring states, and its monetary contributions to the state's treasury.

The research reported here was conducted under the auspices of the West Virginia Agricultural and Forestry Experiment Station at West Virginia University. Major financial support was provided by the West Virginia Governor's Office of Community and Industrial Development and by the Experiment Station. Other principal cooperators include the West Virginia Department of Agriculture (Division of Forestry), the U.S.D.A. Forest Service, and the West Virginia Forestry Association. The investigators gratefully acknowledge the support and cooperation of these agencies and organizations.

HIGHLIGHTS

1. In 1982, West Virginia's wood products industry consisted of some 436 manufacturing establishments employing 6,400 workers. The value of wood products shipped from these establishments totaled more than $382 million, while the amount of value added through manufacturing exceeded $160 million.
2. In 1982, wood products represented only 3.8 percent of the value of all goods manufactured in West Virginia. Employment in the wood industry represented less than 1 percent of the state's total working labor force and provided less than .5 percent of West Virginia's personal incomes. It is estimated that wood-based industrial activity generates less than 1 percent of West Virginia's gross state product.
3. In 1982, wood industries in the state exported more than $111 million worth of wood products. In value terms, more than 85 percent was shipped to markets within the U.S., while 15 percent was destined for foreign countries. Sawmills and planing mills accounted for 45 percent of the value of all wood industry exports, while wood preserving establishments accounted for an additional 20 percent.
4. Wood industry "multipliers" were calculated and used to determine the secondary effects of wood-based activity on the state's economy. In 1982, the estimated direct and indirect contributions from wood products industries amounted to approximately $850 million in gross sales and over $426 million in value added. The wood industry was also responsible for supporting more than 15,200 jobs in West Virginia.
5. In 1984, West Virginia accounted for approximately 16 percent of hardwood lumber production in a six state area, which includes West Virginia and all of its neighboring states. But West Virginia accounted for only 2 percent of the region's value of wood product shipments and less than 2 percent of the region's value added by manufacture of wood products.
6. West Virginia's heavy reliance on timber harvesting and primary conversion industries and its lack of associated secondary manufacturing have resulted in the state becoming the "woodbasket" of the Appalachian region. The undiversified nature of the state's wood industry and its lack of vertical integration has led to the loss of potential jobs, value added, and numerous other economic benefits.
7. In 1982, new capital investment in West Virginia's wood industry was the lowest in the six state region, amounting to only $9.4 million or 1.5 percent of the region's total timber-related capital commitment.
8. In fiscal year 1983–84, public revenue directly attributable to forest-based activity amounted to almost $40 million. Of that total more than 23 percent was attributable to state managed forest-based recreation.

9. The combined annual business tax liability directly attributable to West Virginia's timber-based industry, based on 1981 income levels and 1983 tax laws, was estimated to be approximately $4.3 million for fiscal year 1983. This amounted to less than 1 percent of all business tax revenue in 1983.
10. In 1984, direct payments from National Forest lands in West Virginia totaled more than $1 million. But perhaps the greatest contribution from the National Forest System comes in the form of capital improvements and management benefits.
11. Although forest-based economic contributions to the state are significant, the wood industry has proven to be a smaller and somewhat less interactive force in the West Virginia economy than previously thought.

FORESTS AND THE WEST VIRGINIA ECONOMY

5. The Economic Importance of Forest-Based Industries in West Virginia

Kenneth D. Jones and Gary W. Zinn

INTRODUCTION

In 1982, West Virginia's wood products industry consisted of some 436 manufacturing establishments employing 6,400 workers. The value of wood products shipped from these mills totaled $382 million, while the amount of value added through manufacturing exceeded $160 million [9]. But how important is this level of activity to West Virginia's overall economy?

According to the 1982 U.S. Census of Manufacturers, wood products represented only 3.8 percent of the value of all goods manufactured in the state. Employment in the wood products industry represented less than 1 percent of the state's total working labor force and provided less than .5 percent of West Virginia's personal incomes [12]. The latest input-output model of West Virginia's economy (1982) estimates that wood-based industrial activity generates less than 1 percent of West Virginia's gross state product [4].

Despite this seemingly small contribution to the state economy, it has been shown that wood product industries assume a much greater importance in some counties and are sometimes the only significant source of employment in heavily forested rural localities [3]. And in addition to manufacturing and other timber-related industries, forest-based activity contributes to the public welfare of the state through direct tax payments, construction and maintenance of public roads, and a variety of other social and economic mediums. These indirect benefits are often overlooked. It becomes important, therefore, for the public, state officials, and all institutions to more fully comprehend the regional economic contribution of the state's wood industries, and to understand the interindustry position and relative importance of wood product manufacturing to the state economy.

PART I:

THE WEST VIRGINIA ECONOMY AND THE TIMBER INDUSTRY

West Virginia's Economic Base

Certain industrial activities are basic to growth and development in West Virginia. Industries which sell a large portion of their production to markets outside the state earn income which is used within the state to buy raw materials, pay wages and salaries, etc. These payments represent income to other industries and to wage and salary earners within the state, whose subsequent respending of it further stimulates the state's economy. Industries which earn a large portion of a state's income from outside sources are called its economic base.

Three industries dominate West Virginia's economic base. They are, in declining order of importance: coal, primary metals, and chemicals. Combined, these three industries account for 63.6 percent of all state exports. The relative importance of these industries is shown in Table 1. When these industries are performing poorly, employment, gross state product, and personal income in West Virginia may be adversely affected.

Table 1
Major export industries as percent of state's total exports and gross state product, 1982.

Industry	Percent of Gross State Product	Exports as Percent of Total State Exports
Coal	16.2	34.8
Primary Metals	4.7	15.6
Chemicals & Allied Products	4.4	13.2
	25.3	63.6

Source: [4]

Economic Activity Generated by Timber-based Industries

West Virginia's wood products industry accounts for only one percent of state exports. In 1982, wood products industries in the state exported more than $111 million worth of wood products (Table 2). Sawmills and planing mills accounted for 45 percent of the value of all wood industry exports in 1982. Wood preserving establishments accounted for an additional 20 percent. Two other industry sectors also contributed significantly to wood industry exports; these were wood kitchen cabinets and wooden pallets and skids. Combined, these four industries accounted for 85 percent of the value of all wood products exported from West Virginia [4].

Less than 15 percent of the value of the state's wood industry exports were destined for foreign countries, while over 85 percent was shipped to markets within the U.S. [4].

In 1982, one out of every 25 dollars of manufacturing shipments, value added, and payrolls was directly attributable to the state's wood-based industries [9]. The economic importance of the industry, however, is actually greater than the volume and face value of its material and monetary outputs. As the wood products industry interacts in the state, national, and world economies, it becomes involved in a maze of intermediate transactions, imports and exports, and sales to final consumers. When combined, the direct, indirect, and induced economic activity stimulated by these transactions represents the true magnitude of the wood products industry's economic worth.

Very few industries exist which are 100 percent self-sufficient or completely isolated from one another. The vast majority of business enterprises are extremely interdependent. Tracking the flow of materials and services through the various processing stages and marketing outlets is extremely complex. An insight into the "spider-web" of commercial activity surrounding the state's wood products industry can be obtained with the aid of an input/output model of West Virginia developed by Dr. Everard Lofting (1982) [4].

Table 2
Exports of Wood Products from West Virginia, 1982.
(millions of dollars)

Sector	Foreign	To other States	Total Exports	Percent of Industry Exports
Logging Camps & Contractors	4.505	a	4.505	4.0
Sawmills & Planing Mills, Gen.	8.655	42.014	50.669	45.4
Hardwood Dimension & Flooring	.176	7.954	8.130	7.3
Special Product Sawmills, N.E.C.	.009	*	.009	*
Millwork	.024	*	.024	*
Wood Kitchen Cabinets	.004	13.114	13.118	11.7
Veneer and Plywood	.284	*	.284	.3
Structural Wood Members, N.E.C.	*	*	*	*
Prefabricated Wood Buildings	.199	*	.199	.2
Wood Preserving	.021	22.133	22.154	19.8
Wood Pallets and Skids	.057	9.065	9.122	8.2
Wood Products, N.E.C.	.059	*	.059	*
Wood Containers	.052	*	.052	*
Total Lumber and Wood Products	14.045	94.280	108.325	96.9
Wood Household Furniture	.052	*	.052	*
Upholstered Household Furniture	.007	*	.007	*
Household Furniture, N.E.C.	.004	*	.004	*
Wood TV and Radio Cabinets	.002	1.091	1.093	1.0
Wood Office Furniture	.001	*	.001	*
Wood Partitions and Fixtures	.016	*	.016	*
Total Wood Furniture	.082	1.091	1.173	1.0
Paperboard Mills	1.313	*	1.313	1.2
Envelopes	.066	*	.066	.1
Bags, except Textile Bags	.123	*	.123	.1
Converted Paper Products, N.E.C.	.384	*	.384	.3
Paperboard Containers and Boxes	.309	*	.309	.3
Total Paper and Allied Products	2.195	*	2.195	2.1
Total Wood Products Industry	16.322	95.371	111.693	100.0

* insignificant value or percentage

a This table was compiled from data used in the 1982 input/output model for West Virginia. The I/O model is a non-survey based model relying on data collected from secondary sources. While the table remains fairly accurate in the aggregate, some inaccuracies may appear in individual sectors. This explains why the Logging Camps and Contractors sector shows an insignificant value of exports to other states when in fact West Virginia exports a considerable volume of sawlogs, veneer logs, and pulpwood to other states.

Source: compiled from [4]

Appendix Table A1 summarizes the principal interindustry transactions by wood products industries in West Virginia in 1982. From this table it is possible to identify both the major sources and value of production inputs used by the state's wood industry sectors and the value and destination of that portion of the industry's output which is purchased by other industrial sectors. A portion of that transactions table is reproduced below (Table 3).

For instance, in the case of Logging Camps and Logging Contractors (S.I.C. 2411), the principal input, timber stumpage, is purchased from a sector called Forestry and Fishery Products. In 1982, purchases of timber stumpage by logging camps amounted to $6,515,000 or 44.3 percent of all inputs required by this sector, excluding imports. Similarly, logging camps and contractors sell most of their production (sawlogs and pulpwood) to an industrial sector encompassing Sawmills and Planing Mills. Sales to sawmills from logging camps totaled $36,394,000 in 1982—74 percent of all interindustry sales from Logging Camps and Contractors.

By using this table, interindustry transactions that occur within the state's wood products industry can be identified. Although the table has been condensed from a much larger and more detailed transactions table, it still presents a general marketing profile of each wood industry sector. As such, it adds considerable detail to the overall picture of West Virginia's wood products industry.

Table 3

Principal interindustry transactions by Logging Camps and Contractors in West Virginia, 1982.
($ millions)

Purchases

Sector	Amount	Percent
Forestry and Fisheries Products	6.515	44.3
Logging Camps and Contractors	1.580	10.7
Forest, Greenhouse and Nursery Products	.704	4.8
Steel Wire and Related Products	.345	2.3
Agriculture, Forestry & Fishery Services	.248	1.7
		63.8

Sales

Sector	Amount	Percent
Sawmills and Planing Mills, General	36.394	74.4
Wood Preserving	3.119	6.4
Veneer & Plywood	2.708	5.5
Logging Camps and Contractors	1.580	3.2
Paperboard Mills	1.253	2.6
		92.1

Source: Appendix Table A1

Input-Output Multipliers for West Virginia's Timber-based Industries

An assessment of the wood products industry's contribution to the state's economy must include the secondary effects which result from the industry's interactions with other sectors of the economy. When a sawmill buys logs, for instance, income flows to forest landowners loggers and truckers, while further processing of the logs provides jobs and income to mill workers and related industries.

Multipliers derived from an input-output model of the state's economy are used to estimate the secondary effects of a particular sector's activity on the overall state economy. Multiplier effects may be calculated for the total output, value added, income, and employment which occur as a result of the values of these variables in any given sector. Type I multipliers measure the total effects of *interindustry* business transactions, while Type II multipliers account for both the Type I effects and the additional effects of wage and salary earners spending their income in the state's economy [6].

The latest input-output (I/O) model for West Virginia is for 1982 [4].[1] Using the I/O model, Type I and II multipliers were calculated for value added, income, and employment for the three major segments of West Virginia's wood products industry (Lumber and wood products, S.I.C. 24; Wood furniture and fixtures, S.I.C. 25; Paper and allied products, S.I.C. 26). The results appear in tables 4 through 6. The numbers are interpreted as follows:

Employment Multipliers

For employment, the Type I multiplier for the lumber and wood products industry is 1.60 (Table 4). This means that every full-time employee in West Virginia's lumber and wood products industry directly supports employment for 0.6 additional workers in other manufacturing and business activity in the state, *before* the effects of workers spending their income within the state's economy are accounted for. The Type II employment multiplier for lumber and wood products, 2.53, implies that, when workers' spending of their income is accounted for, every full-time employee in lumber and wood products supports employment for 1.53 additional workers in the state overall.

Value Added and Income Multipliers

Multipliers for value added (the value of shipments minus the cost of materials) and income (value of goods sold) are interpreted in the same manner, using dollar terms. For value added, the lumber and wood products sector's Type I multiplier of 1.73 (Table 5) indicates that for every dollar of value added generated by the sector another 73 cents is generated by other industrial activity directly as a result of lumber and wood products activity. The Type II multiplier value of 2.70 implies that every dollar of value added generated in lumber and wood products ultimately generates another $1.70 in the state's economy as a whole. The multipliers for income are interpreted in exactly the same way.

Comparison and Ranking of Industry Multipliers

Besides multiplier values for the three industry segments which comprise West Virginia's wood products industry, Tables 4 through 6 contain multipliers for these segments combined (all wood industries), the average for all manufacturing, and for two industries which dominate the state's economic base. (Chemicals and allied products, S.I.C. 28; and Primary metal products, S.I.C. 33). The range of multiplier values for the state's twenty manufacturing industries are also shown, and rankings for the particular industry groups are given.

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[1] The West Virginia input-output model used herein was developed by Lofting [4] as one of a series of state-level models to be used by the U.S. Forest Service in evaluating the economic impacts of National Forest management plans.

Table 4
Employment multipliers for selected manufacturing industries, West Virginia, 1982.

Industry	Type I	Rank*	Type II	Rank*
Lumber and wood products (S.I.C. 24)	1.60	7	2.53	10
Furniture and fixtures (S.I.C. 25)	1.49	9	2.49	11
Paper and allied products (S.I.C. 26)	1.47	11	1.68	20
All wood industries	1.55		2.38	
Average for all manufacturing	*1.59*		*2.57*	
Chemicals and allied products (S.I.C. 28)	1.92	4	3.34	2
Primary metal products (S.I.C. 33)	1.72	5	3.25	4
Range of multipliers	1.24–3.62		1.68–3.58	

*Rank among twenty manufacturing industry groups.
Source: [4]

The data in these tables give a good indication of the ultimate effects that activity in West Virginia's wood industries has on the state's economy as a whole, and puts those effects in perspective with the state's leading manufacturing industries. Employment multipliers for lumber and wood products (S.I.C. 24) are comparable to the manufacturing average, while employment multipliers for (wood) furniture and fixtures (S.I.C. 25) and paper and allied products (S.I.C. 26) fall somewhat below the all-manufacturing average. The Type II multiplier for paper and allied products (S.I.C. 26) ranks last among the state's twenty manufacturing industries. This is probably due to the undeveloped nature of the industry, exemplified by the fact that there are only a handful of secondary paper products manufacturing establishments operating in the state. When the three wood industry segments are combined, the wood industries multipliers for employment fall slightly below the manufacturing averages.

Table 4 shows that multipliers for the three wood industry segments rank somewhat behind those for chemicals and allied products and primary metal industries. This pattern, which holds in Tables 5 and 6 as well, indicates that the chemical and primary metal industries are better integrated into the state's overall economy than are the wood products industries. Stated simply, this means that there is more industrial and other business activity within the state associated with or dependent on these two dominant industries than is the case for the wood products industries. This situation relates closely to an observation made in Volume 4 of this report series, where it was noted that the state's wood products industry is dominated by harvesting and primary manufacturing of wood products, with relatively weak development of the secondary wood products industry.

Value added[2] multipliers for the wood industries (Table 5) are somewhat more positive than those for employment. The wood industries' value added multipliers are all above the manufacturing average, except for the Type II multiplier for paper and allied products, which is only slightly below that average. In fact, the Type I multiplier for lumber and wood products and the Type II multiplier for furniture and fixtures are nearly as high as those of the primary metal industries and chemicals and allied products, respectively.

Income multipliers for the lumber and wood products industry are well above the all-manufacturing average and fall only slightly below those of the primary metal industries. The furniture and fixtures multipliers are almost exactly the same as the all-manufacturing average, while those for paper and allied products fall slightly below the average.

Summary of Wood Industry Multipliers

In 1982, West Virginia's wood industries directly employed an estimated 6,400 workers, produced $160.4 million in value added by manufacture, and shipped $381.1 million worth of products [9]. The overall impact of this economic activity on the state's economy can be estimated by applying the appropriate Type II multipliers: for employment; 6,400 workers times the Type II multiplier of 2.38 equals 15,232 workers. That is, besides those 6,400 directly employed in the wood industries, another 8,832 jobs are related to or dependent on wood industry employment. Similarly, the $160.4 million in wood industry value added generated another $266.26 million in value added by other industries in the state. The value of wood industry shipments is analagous to their gross income, so that the $381.1 million in shipments eventually supported another $468.8 million of earned income elsewhere.

The input-output multipliers for West Virginia's wood products industries show that the overall impact of West Virginia's timber-based industry is somewhat greater than that indicated by direct activity alone. The fact that the multiplier effects for wood industry activity are mostly at or above the average for all manufacturing industries gives support to the conclusion that West Virginia's wood industries are a small but significant driving force in the state's economy and an important part of its manufacturing industry. Similarly, the true measure of any gain or loss in wood industry-related economic activity would be reflected through similar multiplier effects.

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[2] Value added is generally agreed to be the best indicator of an industry's performance and contribution to a state economy.

Table 5
Value added multipliers for selected manufacturing industries, West Virginia, 1982.

Industry	Type I	Rank*	Type II	Rank*
Lumber and wood products (S.I.C. 24)	1.73	5	2.70	6
Furniture and fixtures (S.I.C. 25)	1.67	6	2.76	4
Paper and allied products (S.I.C. 26)	1.58	9	2.43	11
All wood industries	1.68		2.66	
Average for all manufacturing	*1.56*		*2.47*	
Chemicals and allied products (S.I.C. 28)	1.87	2	2.80	3
Primary metal products (S.I.C. 33)	1.78	3	2.85	2
Range of multipliers	1.29–2.07		1.93–2.97	

*Rank among twenty manufacturing industry groups.
Source: [4]

The Regional Importance of West Virginia's Wood Products Industry

Although wood products manufacturing plays a small but significant role within West Virginia's economy, its importance as a regional industry is not as great. West Virginia's heavy reliance on timber extraction and primary conversion industries and its lack of associated secondary manufacturing have kept the state's wood-based manufacturing industry from achieving its potential market position relative to timber-related industries in neighboring and competing states.[3] West Virginia has about 18 percent of all commercial forest land, growing stock volume, and hardwood sawtimber volume found in the six state region and accounted for 16 percent of the region's hardwood lumber production in 1984 (Tables 6 & 7). Despite these favorable resource statistics, West Virginia's timber industries contribute only 2 percent of the regional value of wood product shipments (Table 9). And despite having almost 7 percent of all wood manufacturing establishments in the six state area, West

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[3] This six state region includes Kentucky, Maryland, Ohio, Pennsylvania, Virginia, and West Virginia.

Virginia accounts for less than 2 percent of the region's value added attributable to wood product manufacturing.

In the lumber and wood products segment (S.I.C. Group 24) West Virginia's manufacturing statistics barely rival those of Maryland, even though the Mountain State has five times the commercial forest land area and timber volume of its smallest neighbor (Appendix Table B2). Manufacturing statistics for West Virginia's secondary wood industries (S.I.C. Groups 25–26) are even less favorable. Compared with the total production of these S.I.C. groups in the six state region, the economic output from West Virginia's furniture and paper manufacturing segments is practically insignificant, accounting for approximately 2 percent of the value of regional furniture shipments and less than 1 percent of the value of paper product shipments (Appendix Tables B3 & B4). Other selected economic measures of West Virginia's wood products industry have been calculated and included in Appendix Tables B1–13.

Table 6

Income multipliers for selected manufacturing industries, West Virginia, 1982.

Industry	Type I	Rank*	Type II	Rank*
Lumber and wood products (S.I.C. 24)	1.61	5	2.33	6
Furniture and fixtures (S.I.C. 25)	1.48	8	2.14	8
Paper and allied products (S.I.C. 26)	1.45	9	2.09	11
All wood industries	1.54		2.23	
Average for all manufacturing	*1.47*		*2.14*	
Chemicals and allied products (S.I.C. 28)	1.86	2	2.68	2
Primary metal products (S.I.C. 33)	1.64	4	2.36	4
Range of multipliers	1.26–1.98		1.82–2.86	

*Rank among twenty manufacturing industry groups.

Source: [4]

It may appear from these statistics that West Virginia's wood industry and its workers are not as productive as those found elsewhere in the region. This is not the case. Other studies show that in 1984 West Virginia sawmills produced more lumber per sawmill and achieved a higher level of value added per thousand board feet than competitors in Pennsylvania and Kentucky [1]. West Virginia mills were able to produce high quality lumber while paying less for raw materials than sawmills in Pennsylvania and Kentucky [1]. West Virginia sawmills were more productive, due to a higher ratio of production workers to management in West Virginia combined with the lowest production wage rate in the six state area. But because West Virginia's wood products industry lacks diversity and vertical integration, the full economic value of the state's timber resource is not being realized. By not manufacturing finished wood products in the state, West Virginia sacrifices jobs, value, and numerous other economic benefits which could be produced by doing so. Unfortunately, the situation does not seem to be improving.

In 1982, new capital investment in West Virginia's wood industries amounted to only 1.5 percent of the region's total timber-related capital commitment—last among the six states (Table 10). This low level of investment in wood industries has been the trend in West Virginia for almost 20 years. A recent survey of major capital spending projects in North America's solid-wood products industry documents a total of $1.029 billion being spent on new plants and equipment for the period 1985–87 [7]. Of that total, not one dollar of capital spending is slated for West Virginia. If calculated and determined steps are not taken to improve this situation, it appears there is little hope for improvement in the position of West Virginia's wood industry relative to its neighboring states.

Table 7

Area of commercial forest land, net growing stock volume and hardwood sawtimber volume on commercial forest land in West Virginia and neighboring states, 1977.

State	Commercial Forest Land	Net Growing Stock Volume Total	Net Growing Stock Volume Softwood	Net Growing Stock Volume Hardwood	Hardwood Sawtimber Volume
	(1000's acres)		(million cubic feet)		(million bd. ft.)
Kentucky	11,901.9	13,191.6	1,022.6	12,169.0	26,850.0
Maryland	2,522.7	3,888.8	817.2	3,071.6	6,440.2
Ohio	6,028.8	5,024.9	149.9	4,875.0	13,907.7
Pennsylvania	15,923.7	26,210.7	1,993.6	24,217.1	30,537.8
Virginia	15,938.8	23,192.1	5,730.2	17,461.9	37,636.5
West Virginia	11,483.7	16,308.9	1,189.7	15,119.2	26,032.8
Percent*	18.0	18.6	10.9	19.7	18.4

*Percent of regional total

Source: USDA Forest Service. 1981, An Assessment of the Forest and Range Land Situation in the United States. FRR No. 22

Table 8

Lumber production in West Virginia and neighboring states, 1984.
(millions of bd. ft., lumber tally)

State	Total	Softwoods	Hardwoods	Percent of region's hardwood lumber production
Kentucky	272	8	264	15
Maryland/ Delaware	122	56	66	4
Ohio	306	3	303	17
Pennsylvania	481	14	467	26
Virginia	851	466	385	22
West Virginia	285	5	280	16
Total	2317	552	1765	100

Source: U.S. Dept. of Commerce, Bureau of the Census. Current Industrial Reports, Lumber Production and Mill Stocks, 1984. U.S. Government Printing Office, Washington D.C. [4]

Table 9

Value of shipments and value added for the wood products industry (S.I.C. Group 24–26) in West Virginia and neighboring states, 1982.

States	Value of Shipments	Percent of Total	Value Added	Percent of Total
		(millions of dollars)		
West Virginia	381.8	2.0	160.4	1.9
Pennsylvania	7526.8	38.8	3399.7	39.3
Maryland	1260.4	6.5	601.3	7.0
Virginia	3970.5	20.5	1771.7	20.5
Kentucky	1344.5	6.9	577.2	6.7
Ohio	4909.5	25.3	2127.3	24.6

Source: [9]

Table 10
New capital expenditures for the wood products industry (S.I.C. Groups 24–26) for West Virginia and neighboring states, 1982.

States	New capital expenditures	Percent of Total
West Virginia	9.4	1.5
Pennsylvania	211.6	33.7
Maryland	76.2	12.1
Virginia	133.5	21.3
Kentucky	40.2	6.4
Ohio	156.6	25.0

Source: [9]

PART II:
PUBLIC REVENUE DIRECTLY ATTRIBUTABLE TO FOREST LAND AND FOREST PRODUCTS PRODUCTION

In addition to primary and secondary economic activity attributed to West Virginia's wood-based industry, the state receives benefits from forest-related activity through taxation and sales of publicly-owned forest goods. Public revenue from forest land and forest products is derived from the collection of property, business, and sales taxes; in-lieu payments from the National Forest System; revenue generated from the management of the state's forest resources, and others. In fiscal year 1983–84, public revenue directly attributable to forest-based activity amounted to approximately $39.6 million. The single greatest source of public money, excluding the property tax, was from state-managed forest-based recreation, which contributed more than 23 percent of all revenue directly attributable to forest-related activity. A general breakdown of revenue sources is shown in Table 11.

Revenue from State-Owned Forest Land

Sales of forest products from state forest land netted slightly more than $1 million in fiscal year 1983–84. This total included more than $527,000 generated by public timber sales and $300,000 from sales of nursery stock. Fire control and suppression receipts, gas and oil leases, the sale of surplus property, and miscellaneous rentals and sales accounted for the balance. By law, all revenue from these sources are deposited into the state's Forestry Fund [11].

Table 11
Public Revenue from State-Managed Forest Resources (Fiscal Year 1983–84)

Revenue Source	Receipts
Timber Sales	$ 527,137
Nursery Stock Sales	$ 300,936
Total, Forestry Fund	$ 1,021,999
Recreation Fees	$ 9,230,935
Water Resource Receipts	$ 495,174
Wildlife Resource Receipts	$ 8,818,844
Law Enforcement	$ 496,788
Sub-Total	$20,891,813
Business Taxes	$ 4,355,507
Forest Property Taxes*	$13,500,000
National Forest Payments	$ 853,159
Sub-Total	$18,708,666
Total	$39,599,478

*Property tax revenue based on estimated annual levy under the pending soil productivity tax law.
Source: [5, 8, 11, 13]

Revenues to the Forestry Fund, however, accounted for less than 5 percent of all revenue directly attributable to publicly-owned forest resources. Other aspects of forest land and resource use were, collectively, of far greater importance as revenue generators. These sources included public recreation fees, water and wildlife receipts, federal and special revenue funds, and law enforcement efforts. In fiscal year 1983–84, revenue from these sources totaled more than $20 million [11].

Contributing to this total were user fees and receipts from state parks, forests and recreation areas; these amounted to about $9.2 million in 1983. Wildlife receipts, which included hunting and fishing license sales, contributed $8.8 million. The balance was collected from selected water resource funds and from permits, fees, and fines levied by the Department of Natural Resources' Law Enforcement Division.

Business Tax Revenue Attributable to West Virginia's Forest Industries

West Virginia's major business taxes include the Business and Occupation Tax, the Corporate Net Income Tax, and the Carrier Income Tax. In 1983, these three business taxes provided better than 40 percent of all state tax revenue.

The combined annual business tax liability directly attributable to West Virginia's timber-based industry, based on 1981 income levels and 1983 tax laws, was estimated to be $4,335,507 for fiscal year 1983 [8]. This amounted to less than 1 percent of all business tax revenue in 1983 [8].

The Business and Occupation (B&O) Tax is a tax on the privilege of doing business in West Virginia. It is the largest single source of revenue for the state. Under 1983 tax laws and using 1981 income levels, the gross B&O Tax liabilities and share of taxes attributed to West Virginia's timber-based industries in fiscal year 1983 were estimated to be approximately $3.9 million (Table 12)—90% of the total business tax contribution attributable to the state's timber industries [8].

The Corporate Net Income (CNI) Tax, which was designed to have only limited application in terms of ultimate tax liability, accounted for approximately 4.5% of the wood industry's tax contribution—collecting an estimated $196,222 in 1983.

Table 12
The wood products industry's B&O and CNI tax liability for fiscal year 1983, assuming 1981 income levels.

Industry	Estimated 1983 B&O Tax	Percent Share of Total 1983 B&O Tax	Estimated 1983 CNI Tax	Percent Share of Total CNI Tax
Timber Production	$ 334,000	.067	NA	NA
Agriculture, Forestry, and Fish	$ 304,738	.060	$ 15,373	0.126
Logging and Sawmills	$ 941,610	.196	$ 8,909	0.073
Furniture and Wood Products	$2,355,831	.490	$171,940	1.410
Total	$3,936,179	.813	$196,222	1.609

B&O—Business and Occupation Tax
CNI—Corporate Net Income Tax
Source: [8]

The remainder of the timber industry's state business tax obligation is represented by the Carrier Income Tax. This tax is levied on the gross annual income of specified transportation and related activities occurring solely within West Virginia. Among the various businesses subject to the Carrier Income Tax are: motor vehicles, railroads, airline companies, and watercraft carriers.

The timber-based industry's direct contribution to the state Carrier Income Tax in 1981 was approximately $6,884 and represented .033 percent of all Carrier Taxes paid that year [8].

Combined, these three business taxes represent less than .25% of the value of wood products shipped in 1982. Of course, these are only estimates, but it appears that the wood products industry's contribution to the state through business tax revenue is very small. However, this contribution does not include all taxes paid by the state's timber-based industry.

Property Tax Revenue Attributable to Forest Land

In 1983, total revenue from property taxes in West Virginia amounted to $383,045,100 [12]. However, forest land was not distinguished from non-forest land but was categorized into one of four classes of property as described in Table 13. The amount of property taxes levied on forest land and timber, therefore, is uncertain. What is known is that the state is more than 80 percent forested and that there are approximately 10.33 million acres of private forest land in the state. Tracts of forest land which are unoccupied are generally assessed under class III property, the timber ordinarily being assessed in conjunction with the land.

Prior to 1985, appraised valuations of property were far below market value with large variations among counties in tax rates as well as the percentage of assessed to appraised value. Thus, under the ad valorem property tax system, it is extremely difficult to estimate forest land's contribution to the state through property taxation. In 1983, however, property tax levies on class III real estate amounted to $51,053,500 [12]; no doubt a significant percentage of this was derived from forest land and timber assessments.

Table 13

Property Tax Classifications, West Virginia, 1984.

Class I	Tangible personal property used exclusively in agriculture, products of agriculture (including livestock) while owned by the producer, and all intangible personal property;
Class II	All property owned, used and occupied by the owner exclusively for residential purposes; all farms occupied and cultivated by their owners or *bona fide* residents;
Class III	All real and personal property situated outside of municipalities exclusive of classes I and II above;
Class IV	All real and personal property situated inside of municipalities exclusive of classes I and II.

Source: State Tax Commissioner's Annual Report

The Tax Limitation and Homestead Exemption Amendment of 1982 required a complete statewide property reappraisal. The reappraisal was designed to be uniform from county to county and had to be completed by March 31, 1985. As part of the reappraisal, but still subject to legislative approval, timberland will be taxed and appraised based upon soil productivity, or in other words, upon the land's ability to grow timber.[4] Under this new system forest land is classified according to three productivity ratings: good, fair, and poor. Stumpage values, management costs, and interest rates are also used in a formula to provide the basis for productivity assessments.[5] Under this system, timberland will be defined as any privately-owned, forested tract exceeding ten acres, which is not part of a farm. In the aggregate, timberland so defined covers about 8.5 million acres, or about 55 percent of the state's land area. A very rough estimate of the total appraised value of timberland, under the pending legislation, would be about $900 million, with the total tax levy being about $13.5 million annually [13].

Revenue Received from National Forest Lands[6]

There are 974,301 acres of land in West Virginia which belong to the National Forest System and are managed by the U.S. Forest Service (Table 14). Although federally-owned land is exempt from state and local taxes, federal law does require compensation to be made to those states where federal lands exist. This compensation can be in the form of direct payments, such as payments in lieu of taxes (PILT), or indirectly through appropriations for capital improvements and highway construction and maintenance. In fiscal year 1984, direct payments from National Forest lands in West Virginia totaled more than $1,000,000 (Table 15). These funds, as well as other types of compensation from the National Forest System, are an important source of public money in counties with a high percentage of federally-owned land.

The 25% Fund

Established by an Act of Congress in 1908 (25% Fund Act) and last amended by the National Forest Management Act of 1976, the 25% Fund Act states that "Twenty-five percentum of all monies received from each national forest shall be paid by the Secretary of the Treasury to the state, to be expended as the state Legislature may provide, for the benefit of the public schools and public roads of the county or counties within which such national forest land is situated." These acts further provided that county shares of these funds shall be proportionate to the acreage of national forest land in each county.

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[4] As of the end of the 1986 West Virginia Legislative Session the forest soil productivity tax had not been implemented.

[5] Land Value =[(timber yield) × (avg. stumpage price – typical management costs)] / capitalization rate. Source: [2]

[6] All reference in this section is to Mahoney [5].

These 25% Fund payments are made for national forest lands throughout the country, based on receipts from timber sales (including K–V Fund collections and purchaser road credits), mineral leases and royalties, special land use fees, recreation fees, and grazing fees. Use of the payments is limited to public schools and roads.

The county shares of the 25% Fund vary from year to year depending on total national forest receipts. Receipts depend on the volume and value of timber, minerals and use permits sold or leased. The amount received by an individual county may fluctuate as national forest acreage changes through acquisition or disposal.

The total 25% Fund payment to West Virginia was $326,136 in 1984—an increase of 153 percent since 1978 (Table 15).

Payments in Lieu of Taxes (PILT)

The Act of October 20, 1976 (Payments in Lieu of Taxes Act) directed that annual payments be made to each unit of local government in which certain federal lands, designated "entitlement lands," are located. Payments are made each fiscal year (beginning in FY 1977) based on the number of entitlement acres and certain other considerations. The funds may be used by the local governments for any governmental purposes.

The computation of the amount of payments is somewhat involved, but basically each entitlement acre qualifies for a payment of 75 cents, reduced by the amount of specified federal payments received by that unit of government during the preceding fiscal year. Historically, payments in West Virginia have ranged from 65 cents/acre (FY77) to 75 cents/acre (FY81) and have averaged 70 cents/acre over the eight years that payments have been made. In FY 1984, West Virginia received $685,810 from the national forests as payments in lieu of taxes. Payments made to individual counties in West Virginia are shown in Table 15.

Forest Service Capital Investments in Forest Land

Federal Highway Programs: Forest Highways

A portion of the annual authorization for the Federal Highway Administration of the U.S. Department of Transportation is specifically designated for use in the construction or improvement of federal, state, or other public roads to meet national forest management needs. The Federal Highway Administration allocates these funds for use in each state containing National Forest System lands. The funds can be used to pay for up to 100 percent of the cost of a particular project or may be supplemented by state or other available funds.

The Forest Service, the West Virginia Department of Highways, and the Federal Highway Administration have jointly determined which roads are eligible for such funding and periodically schedule projects according to the availability of funds. In recent years, the funds allocated to West Virginia have been used almost exclusively for the replacement of substandard bridges on the state road system. West Virginia's allocation of Forest Highway funds in fiscal year 1985 was $287,379.

Federal Highway Programs: Public Lands Highways

Highways on the federal-aid system which pass through federal lands (interpreted to mean that federal land is present on both sides of the highway) may be nominated by the individual states for financing through the Public Lands Highway Fund. The Department of Transportation allocates these funds based on state needs, with preference to projects significantly impacted by federal land or resource management activities. Although used relatively little in West Virginia, it would be reasonable that eligible projects could be identified within the state. The annual authority has been increased from $16 million to $50 million on a national basis in recent years.

Table 14

Area of National Forest and Entitlement Lands, by Counties, West Virginia, 1984.

County	National Forest	National Forest Lands (9/30/84) (Acres)	Entitlement Lands (10/1/83) (Acres)
Barbour	Monongahela	11	11
Grant	Monongahela	19,431	19,214
Greenbrier	Monongahela	100,945	100,849
Hampshire	George Washington	2,249	2,249
Hardy	George Washington	49,285	49,285
Monroe	Geo. Wash./Jefferson[a]	18,796	18,796
Nicholas	Monongahela	23,540	23,540
Pendleton	Mon./Geo. Washington[a]	129,640[b]	129,640
Pocahontas	Monongahela	288,089	288,089
Preston	Monongahela	3,897	3,897
Randolph	Monongahela	178,572	178,465
Tucker	Monongahela	94,157	94,157
Webster	Monongahela	65,689	64,784
Total West Virginia		974,301[b]	972,513

[a] Counties with lands from more than one National Forest

Monroe	George Washington	418 acres
	Jefferson	18,380 acres
Pendleton	Monongahela	80,534 acres[b]
	George Washington	49,106 acres

[b] An additional 109 acres outside the Forest Boundary are not included in the 25% Fund computation. Total acres in Pendleton County = 129,749.

Source: [5]

Table 15
25% Fund and Payments in Lieu of Taxes, W.Va., by County.

		Monongahela National Forest										
		Barbour	Grant	Greenbrier	Nicholas	Pendleton	Pocahontas	Preston	Randolph	Tucker	Webster	Total Monongahela
1977	25%	1	1,932	11,592	2,705	8,668	32,963	448	20,299	10,801	7,444	96,852
	PILT	7	10,129	65,025	15,190	46,797	184,979	2,515	113,906	60,689	41,803	541,040
1978	25%	2	2,345	13,892	3,242	10,439	39,503	537	24,463	12,944	8,921	115,658
	PILT	8	11,889	72,044	16,828	53,941	204,938	2,786	126,197	67,228	46,311	602,170
1979	25%	2	2,912	17,243	4,023	13,198	49,130	666	30,397	16,093	11,073	144,737
	PILT	8	10,572	66,276	15,479	55,358	188,529	2,563	116,746	61,841	42,114	559,486
1980	25%	2	3,622	21,364	4,985	16,569	60,871	825	37,701	19,939	13,719	179,597
	PILT	8	11,732	74,458	17,390	54,165	212,231	2,879	131,304	69,544	47,859	621,570
1981	25%	4	5,739	33,715	7,862	26,339	96,178	1,302	59,581	31,447	21,637	283,803
	PILT	8	11,749	75,592	17,655	54,025	215,463	2,923	133,443	70,654	48,588	630,100
1982	25%	2	3,948	21,067	4,913	16,472	60,124	813	37,268	19,650	13,520	177,778
	PILT	8	10,613	69,510	16,225	51,590	198,370	2,686	122,883	64,896	44,652	581,433
1983	25%	3	5,227	27,463	6,404	21,799	78,377	1,060	48,583	25,617	17,625	232,155
	PILT	8	19,917	71,273	16,637	47,322	203,484	2,754	126,126	66,541	45,785	599,839
1984	25%	4	6,627	34,428	8,028	27,466	98,254	1,329	60,902	32,112	22,403	291,554
	PILT	8	12,408	72,470	16,916	50,438	206,903	2,800	128,245	67,661	46,554	604,403

Table 15 (con't.)

George Washington/Jefferson National Forests

	Hampshire	Hardy	Monroe	Pendleton	Total Pendleton	Total WV
1977 25%	N/A	N/A	N/A	N/A	N/A	
PILT	1,918	34,566	13,772	34,322	81,119	625,818
1978 25%	310	5,559	1,184	5,660	16,099	129,000
PILT	1,965	35,523	14,163	35,033	88,974	688,854
1979 25%	399	7,217	1,271	7,289	20,487	160,914
PILT	1,763	31,866	12,131	35,775	91,133	627,823
1980 25%	464	8,389	2,566	8,492	25,061	199,508
PILT	1,981	35,835	13,785	33,203	87,368	706,374
1981 25%	729	13,213	3,601	8,492	34,831	309,838
PILT	2,010	36,381	13,993	33,907	88,032	716,391
1982 25%	749	16,413	3,703	16,354	32,826	214,996
PILT	1,848	33,500	12,859	32,080	83,670	661,720
1983 25%	785	17,208	6,925	17,145	38,944	274,223
PILT	1,590	34,831	13,266	29,402	76,724	678,936
1984 25%	637	13,954	6,067	13,904	41,370	326,136
PILT	1,616	35,416	13,507	30,868	81,306	685,810

Source: [5]

Other Capital Improvements

In managing National Forests, the Forest Service is responsible for protecting, maintaining, operating, and developing federal lands and resources. Capital improvements are funded through a combination of appropriated funds, specially authorized cooperative accounts, and work performed by private parties, including timber sale purchasers and special use permittees.

I. Appropriated Funds

Appropriated funds are provided each fiscal year, usually for one year only, through the Appropriations Act for the Department of Interior and Related Agencies. The appropriations bill identifies funds to be expended for specific activities such as timber sales, reforestation and timber stand improvement, recreation management, wildlife habitat improvement, fire protection, road and trail construction and maintenance, and land acquisition. Funds are allocated to the various Forest Service Regions and ultimately to individual national forests and ranger districts. Expenditures on a state-by-state basis are not readily identifiable, especially where national forests, such as the George Washington and Jefferson, occur in two or more states.

II. Cooperative Funds

The Knutson-Vandenburg Act of June 9, 1930, as amended, authorized collections (KV Funds) from timber sale purchasers for purposes of reforestation, timber stand improvement, and for the protection and improvement of other renewable resources within timber sale areas (e.g., recreation, wildlife, and water). The money can be spent only within timber sale areas and cannot be used for maintenance, planning, or fire protection. Projects and funding needs are identified during the timber sale planning process. Funds are actually collected as part of the stumpage payments. These collections represent a reduction in return to the U.S. Treasury, but are included in total receipts for purposes of determining the amount of the 25% Fund payments. The funds are spent within a few years of collection to accomplish the identified projects. Approximately $97,000 was collected on the Monongahela National Forest in FY 1984. This was roughly 11 percent of the value of the 24.9 MMBF of timber harvested that year.

SUMMARY

Timber-related industrial activity in West Virginia accounts for less than 1 percent of the state's gross output and barely 1 percent of the value of state exports. But despite this small direct contribution to the West Virginia economy, the wood products industry is indirectly responsible for a significant amount of related industrial activity. Combined, the estimated direct and indirect contributions from wood products industries in West Virginia amount to approximately $850 million in gross sales, over $426 million in value added, and are responsible for providing jobs for more than 15,200 West Virginians. Although small, the wood products industry is, nonetheless, a significant segment of the state's economy.

The state's timber-based industry as a whole, however, remains heavily dependent on primary conversion activities and has failed to develop a strong secondary wood manufacturing sector. In 1982, primary wood industries accounted for 96% of the value of all wood product exports from West Virginia. This lack of vertical integration and failure to further process lumber and wood into higher-value products has greatly limited the economic contributions of West Virginia's timber resource. It has forced West Virginia to become the raw wood basket of the region.

In terms of direct monetary inputs to the State Treasury, the wood industries actually contribute very little—only $4 to 5 million in business taxes. Property taxes on privately-owned timberland contribute considerably more, although the exact amount is unknown. Forest-based activities combined, however, directly contribute approximately $40 million, with more than half of that attributable to receipts from state-provided recreation and wildlife activity. Annual payments from National Forest lands in West Virginia also provide some $1 million in public funds which support education and roads, but perhaps the greatest contribution from the National Forest System comes in the form of capital improvements and management benefits.

In summary, the wood industry has proven to be a smaller and somewhat less interactive force in the West Virginia economy than previously thought. Serious deficiencies in the structure of West Virginia's timber and wood products industry have negated any economic advantage inherent in its abundant timber resource. The potential for expansion remains great. But it will require a committed, well planned, and long term economic development program to strengthen, diversify, and invigorate the state's wood-based industry before the full benefits from timber and wood products manufacturing can be realized.

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Appendix A

Table A1

Principal interindustry transactions by wood products industries in West Virginia, by industry, 1982.[1]
(in millions of dollars)

Purchases			Sales		
Logging Camps and Logging Contractors (S.I.C. 2411)					
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Forestry & Fishery Products	6.515	44.3	Sawmills & Planing Mills, General	36.394	74.4
Logging Camps & Logging Contractors	1.580	10.7	Wood Preserving	3.119	6.4
Forest, Greenhouse & Nursery Products	.704	4.8	Veneer & Plywood	2.708	5.5
Steel Wire & Related Products	.345	2.3	Logging Camps & Logging Contractors	1.580	3.2
Agriculture, Forestry & Fishery Services	.248	1.7	Paperboard Mills	1.253	2.6
		63.8			92.1
Sawmills and Planing Mills, General (S.I.C. 2421)					
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Logging Camps & Logging Contractors	36.394	65.5	New Construction	15.894	30.9
Sawmills & Planing Mills, General	6.047	10.9	Wood Preserving	8.007	15.6
Wholesale Trade	3.202	5.8	Sawmills & Planing Mills, General	6.047	11.8
Railroads & Related Services	2.239	4.0	Wood Pallets & Skids	2.817	5.5
Electric Services	1.598	2.9	Maintenance & Repair Construction	2.424	4.7
		89.1			68.5
Hardwood Dimension and Flooring (S.I.C. 2426)					
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Sawmills & Planing Mills, General	2.380	44.7	Wood Kitchen Cabinets	.550	20.0
Wholesale Trade	.693	13.0	New Construction	.413	15.0
Logging Camps & Logging Contractors	.517	9.7	Wood Household Furniture	.375	13.6
Petroleum Refining & Misc. Products	.284	5.3	Bituminous & Lignite Mining Services	.245	8.9
Railroads & Related Services	.217	4.0	Upholstered Household Furniture	.184	6.7
		76.7			64.2

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[1] Does not include imports, exports, or sales to final consumers.

Table A1 (cont.)

Special Product Sawmills, n.e.c. (S.I.C. 2429)

Purchases			*Sales*		
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Logging Camps & Logging Contractors	.187	54.0	New Construction	.453	64.2

Millwork (S.I.C. 2431)

Purchases			*Sales*		
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Sawmills & Planing Mills, General	.832	40.5	New Construction	3.452	81.2
Wholesale Trade	.341	16.6	Maintenance & Repair Construction	.512	12.0
Veneer & Plywood	.124	6.0			93.2
		63.1			

Wood Kitchen Cabinets (S.I.C. 2434)

Purchases			*Sales*		
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Veneer & Plywood	.890	14.2	New Construction	4.704	93.7
Wholesale Trade	.862	13.7	Maintenance & Repair Construction	.231	4.6
Sawmills & Planing Mills, General	.717	11.4			98.3
Miscellaneous Plastic Products	.622	9.9			
Hardwood Dimension & Flooring Mills	.550	8.7			
		57.9			

Veneer and Plywood (S.I.C. 2435)

Purchases			*Sales*		
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Logging Camps & Logging Contractors	2.708	45.0	New Construction	6.010	50.5
Veneer & Plywood	1.120	18.6	Veneer & Plywood	1.120	9.4
Wholesale Trade	.614	10.2	Wood Kitchen Cabinets	.890	7.5
Railroads & Related Services	.281	4.7	Maintenance & Repair Construction	.790	6.6
Sawmills & Planing Mills, General	.258	4.3	Public Building Furniture	.332	2.8
		82.8			76.8

Table A1 (cont.)

Structural Wood Members, n.e.c. (S.I.C. 2439)

Purchases			*Sales*		
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Sawmills & Planing Mills, General	.339	51.0	New Construction	1.317	89.2
Wholesale Trade	.118	15.1			
		66.1			

Wood Pallets and Skids (S.I.C. 2448)

Purchases			*Sales*		
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Sawmills & Planing Mills, General	2.817	46.4	Wholesale Trade	1.976	52.9
Wholesale Trade	.802	13.2	Electrometallurgical Products	.241	6.4
Logging Camps & Logging Contractors	.628	10.3	Glass Containers	.225	6.0
Railroads & Related Services	.271	4.5	Blast Furnaces & Steel Mills	.127	3.4
Veneer & Plywood	.173	2.8	Aluminum Rolling & Drawing	.120	3.2
		77.2			71.9

Wood Containers (S.I.C. 2449)

Purchases			*Sales*		
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Sawmills & Planing Mills, General	.639	29.4	Glass & Glass Products, Except Containers	2.317	51.3
Logging Camps & Logging Contractors	.265	12.2	Aluminum Rolling & Drawing	.561	12.4
Wholesale Trade	.245	11.3	Fruits & Tree Nuts	.516	11.4
Veneer & Plywood	.159	7.3	Wholesale Trade	.144	3.2
Paperboard Containers & Boxes	.154	7.1			78.3
		67.3			

Prefabricated Wood Buildings (S.I.C. 2452)

Purchases			*Sales*		
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Sawmills & Planing Mills, General	.475	25.2	New Construction	4.127	99.2
Wholesale Trade	.307	16.3			
Veneer & Plywood	.153	8.1			
		49.6			

Table A1 (cont.)

Wood Preserving (S.I.C. 2491)

Purchases			*Sales*		
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Sawmills & Planing Mills, General	8.007	32.8	Bituminous & Lignite Mining Services	15.290	82.3
Industrial Inorganic, Organic Chemicals	3.779	15.5	New Construction	1.796	9.7
Logging Camps & Logging Contractors	3.119	12.8	Maintenance & Repair Construction	.795	4.3
Wholesale Trade	2.425	9.9	Wood Preserving	.387	2.1
Petroleum Refining & Misc. Products	1.678	6.9	Hand & Edge Tools, n.e.c.	.203	1.1
		77.9			99.5

Wood Products, n.e.c. (S.I.C. 2499)

Purchases			*Sales*		
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Sawmills & Planing Mills, General	.334	17.4	Glass & Glass Products, Except Containers	.637	20.4
Wholesale Trade	.223	11.6	New Construction	.347	10.5
Electric Services	.159	8.2	Hand & Edge Tools, n.e.c.	.331	10.0
Logging Camps & Logging Contractors	.159	8.2	Games, Toys, & Children's Vehicles	.157	4.8
Paints and Allied Products	.100	5.2	Gaskets, Packing & Sealing Devices	.155	4.7
		50.6			50.4

Wood Household Furniture (S.I.C. 2511)

Purchases			*Sales*		
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Sawmills & Planing Mills, General	1.014	20.0	Glass & Glass Products, Except Containers	.125	41.2
Wholesale Trade	.756	14.9			
Hardwood Dimension & Flooring Mills	.375	7.4			
Paints & Allied Products	.290	5.7			
Veneer & Plywood	.248	4.9			
		52.9			

Wood TV and Radio Cabinets (S.I.C. 2517)

Purchases			*Sales*		
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Miscellaneous Plastic Products	.163	16.2	Radio & TV Communication Equipment	.017	24.3
Wholesale Trade	.112	11.1	Personal & Repair Services, Except Auto.	.016	22.8
Sawmills & Planing Mills, General	.107	10.6			47.1
		37.9			

Table A1 (cont.)

Wood Office Furniture (S.I.C. 2521)

Purchases			*Sales*		
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Sawmills & Planing Mills, General	.024	12.1	New Construction	.005	45.4
Hardwood Dimension & Flooring Mills	.013	6.5			
Miscellaneous Business Services	.018	9.0			
		27.6			

Wood Partitions and Fixtures (S.I.C. 2541)

Purchases			*Sales*		
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Miscellaneous Plastic Products	.208	17.5	New Construction	.454	70.9
Wholesale Trade	.121	10.2	Maintenance & Repair Construction	.122	19.1
Sawmills & Planing Mills, General	.105	8.8			90.0
		36.5			

Paperboard Mills (S.I.C. 2631)

Purchases			*Sales*		
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Logging Camps & Logging Contractors	1.253	15.1	Paperboard Containers & Boxes	9.747	54.5
Petroleum Refining & Misc. Products	1.069	12.8	Industrial Inorganic, Organic Chemicals	1.539	8.6
Sawmills & Planing Mills, General	.939	11.3	Miscellaneous Plastic Products	1.188	6.6
Wholesale Trade	.888	10.7	Cellulosic Man-made Fibers	.852	4.8
Electric Services	.584	7.0	Newspapers	.654	3.7
		56.9			78.2

Envelopes (S.I.C. 2642)

Purchases			*Sales*		
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Wholesale Trade	.125	23.9	Miscellaneous Business Services	.353	16.9
Paperboard Mills	.055	10.5	Retail Trade	.270	12.9
		34.4	Banking	.261	12.5
			Nonprofit Organizations	.160	7.7
			Scrap, Used, & Secondhand goods	.120	5.8
					55.8

Table A1 (cont.)

Bags, Except Textile Bags (S.I.C. 2643)

Purchases			*Sales*		
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Plastic Materials & Resins	1.794	31.1	Retail Trade	4.662	31.6
Wholesale Trade	.695	12.0	Industrial Inorganic, Organic Chemicals	2.290	15.5
Miscellaneous Plastics Products	.635	11.0	Agricultural Chemicals, n.e.c.	1.732	11.7
Industrial Inorganic, Organic Chemicals	.535	9.3	Wholesale Trade	.768	5.2
Paperboard Mills	.185	3.2	Bituminous & Lignite Mining Services	.637	4.3
		66.6			68.3

Converted Paper Products, n.e.c. (S.I.C. 2649)

Purchases			*Sales*		
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Miscellaneous Plastics Products	.346	18.5	New Construction	.591	16.5
Wholesale Trade	.272	14.5	Wholesale Trade	.566	15.8
Paperboard Mills	.232	12.4	Hospitals	.439	12.2
Paperboard Containers & Boxes	.114	6.1	Maintenance & Repair Construction	.421	11.7
Industrial Inorganic, Organic Chemicals	.096	5.1	Doctors & Dentists	.338	9.4
		56.6			65.6

Paperboard Containers and Boxes (S.I.C. 265)

Purchases			*Sales*		
Sector	*Amount*	*Percent*	*Sector*	*Amount*	*Percent*
Paperboard Mills	9.747	54.3	Glass Containers	7.355	14.8
Railroads & Related Services	1.235	6.9	Industrial Inorganic, Organic Chemicals	3.760	7.6
Paperboard Containers & Boxes	1.060	5.9	Glass & Glass Products	3.072	6.7
Wholesale Trade	.749	4.2	Eating & Drinking Places	2.251	4.5
Motor Freight Transport & Warehousing	.579	3.2	Fluid Milk	2.077	4.2
		74.5			37.8

Appendix B

Table B1

Manufacturing statistics for the wood products industry (S.I.C. Groups 24–26) for West Virginia and neighboring states, 1982.

	Number of establishments	Number of employees	Payroll	Value added	Cost of materials	Value of shipments	New Capital expenditures
			millions of dollars				
West Virginia	436	6,400	76.6	160.4	223.1	381.8	9.4
Percent*	(6.77)	(2.86)	(2.05)	(1.86)	(2.07)	(1.97)	(1.50)
Pennsylvania	1,996	73,500	1,309.5	3,399.7	4,119.8	7,526.8	211.6
Maryland	454	16,500	276.2	601.3	669.5	1,260.4	76.2
Virginia	1,470	55,700	788.2	1,771.7	2,207.7	3,970.5	133.5
Kentucky	647	16,000	242.1	577.2	760.9	1,344.5	40.2
Ohio	1,437	55,600	1,034.0	2,127.3	2,791.2	4,909.5	156.6
Totals	6,440	223,700	3,726.6	8,637.6	10,772.2	19,393.5	627.5

*Percent of regional total

Source: [9]

Table B2

Manufacturing statistics for the lumber and wood products industry (S.I.C. Group 24) for West Virginia and neighboring states, 1982.

	Number of establishments	Number of employees	Payroll	Value added	Cost of materials	Value of shipments	New capital expenditures
			millions of dollars				
West Virginia	375	4,200	45.0	91.1	122.6	212.0	5.9
Percent*	(8.74)	(6.62)	(5.49)	(5.66)	(5.22)	(5.34)	(6.20)
Pennsylvania	1,208	17,000	235.1	483.1	640.0	1,131.4	22.8
Maryland	268	3,400	45.4	87.7	131.4	220.8	8.6
Virginia	1,187	19,600	243.3	446.3	785.5	1,230.4	30.8
Kentucky	499	7,500	88.9	163.5	228.2	396.2	9.8
Ohio	753	11,700	162.3	336.2	439.6	776.2	17.3
Totals	4,290	63,400	820.0	1,607.9	2,347.3	3,967.0	95.2

*Percent of regional total

Source: [9]

Table B3

Manufacturing statistics for the furniture and fixtures industry (S.I.C. Group 25) for West Virginia and neighboring states, 1982.

	Number of establishments	Number of employees	Payroll	Value added	Cost of materials	Value of shipments	New capital expenditures
			millions of dollars				
West Virginia	36	900	10.7	22.5	38.7	60.2	0.5
Percent*	(3.26)	(1.46)	(1.24)	(1.29)	(2.50)	(1.82)	(0.64)
Pennsylvania	410	18,900	299.4	638.0	526.2	1,160.5	33.9
Maryland	110	3,500	51.2	94.3	100.2	189.0	4.1
Virginia	182	22,500	246.6	471.4	426.7	911.1	20.7
Kentucky	86	2,800	36.1	74.3	65.9	139.8	3.9
Ohio	279	13,000	220.8	447.8	389.4	841.4	15.5
Totals	1,103	61,600	864.8	1,748.3	1,547.1	3,302.0	78.6

*Percent of regional total

Source: [9]

Table B4

Manufacturing statistics for the paper and allied products industry (S.I.C. Group 26) for West Virginia and neighboring states, 1982.

	Number of establishments	Number of employees	Payroll	Value added	Cost of materials	Value of shipments	New capital expenditures
			millions of dollars				
West Virginia	25	1,300	20.9	46.8	61.8	109.6	3.0
Percent*	(2.39)	(1.32)	(1.02)	(0.89)	(0.90)	(0.90)	(0.66)
Pennsylvania	378	37,600	775.0	2,278.6	2,953.6	5,234.9	154.9
Maryland	76	9,600	179.6	419.3	437.9	850.6	63.5
Virginia	101	13,600	298.3	854.0	995.5	1,829.0	82.0
Kentucky	62	5,700	117.1	339.4	466.8	808.5	26.5
Ohio	405	30,900	650.9	1,343.3	1,962.2	3,291.9	123.8
Totals	1,047	98,700	2,041.8	5,281.4	6,877.8	12,124.5	453.7

*Percent of regional total

Source: [9]

Table B5

Value added by manufacture per production worker for the wood products industry in West Virginia and neighboring states, 1982.

	Value added per production worker			Percent above or below region average		
	(S.I.C 24)	(S.I.C. 25)	(S.I.C. 26)	(S.I.C. 24)	(S.I.C. 25)	(S.I.C. 26)
Kentucky	$26,371	$32,304	$77,136	–16.7	– 8.9	+10.8
Maryland	31,321	33,679	67,629	– 1.0	– 5.1	– 2.9
Ohio	35,766	45,694	57,406	+13.0	+28.8	–17.6
Pennsylvania	35,522	44,615	79,951	+12.2	+25.8	+14.8
Virginia	27,720	24,425	83,725	–12.4	–31.2	+20.2
West Virginia	24,622	32,143	52,000	–22.2	– 9.4	–25.3
Regional average[a]	31,652	35,477	69,641			

[a] Average based on $\frac{\text{Total value added for region}}{\text{Total \# prod. workers}}$

Note: S.I.C. 24—lumber and wood products
S.I.C. 25—furniture and fixtures
S.I.C. 26—paper and allied products

Source: [9]

Table B6

Value added by manufacture per dollar of production wage outlay in the wood products industry in West Virginia and neighboring states, 1982.

	Value added per dollar of production wages			Percent above or below region average		
	(S.I.C 24)	(S.I.C. 25)	(S.I.C. 26)	(S.I.C. 24)	(S.I.C. 25)	(S.I.C. 26)
Kentucky	2.42	2.90	4.27	−11.0	− 1.0	+ 9.8
Maryland	2.58	2.81	4.20	− 5.1	− 4.1	+ 8.0
Ohio	2.91	3.05	3.00	+ 7.0	+ 4.1	−22.9
Pennsylvania	2.85	3.19	4.31	+ 4.8	+ 8.9	+10.8
Virginia	2.65	2.57	4.15	− 2.6	−12.3	+ 6.7
West Virginia	2.48	2.71	3.41	− 8.8	− 7.5	−12.3
Regional average[a]	2.72	2.93	3.89			

[a] Average based on regional totals

Note: S.I.C. 24—lumber and wood products
S.I.C. 25—furniture and fixtures
S.I.C. 26—paper and allied products

Source: [9]

Table B7

Value added by manufacture per $100 cost of materials for the wood products industry in West Virginia and neighboring states, 1982.

State	Total	Value added per $100 cost of materials (S.I.C. 24)	(S.I.C. 25)	(S.I.C. 26)
		in 1982 dollars		
Kentucky	73.23	71.65	112.75	72.71
Maryland	89.81	66.74	94.11	68.46
Ohio	76.21	76.48	115.00	95.75
Pennsylvania	82.52	75.48	121.25	77.15
Virginia	77.53	56.82	110.48	85.79
West Virginia	71.90	74.31	58.14	75.73
	(-10.3)	(+8.5)	(-48.5)	(-1.4)
Regional Average	80.18	68.50	113.00	76.79

( )—percent above/below regional average
Source: [9]

Table B8

Value added by manufacture per $100 dollars of shipments for the wood products industry in West Virginia and neighboring states, 1982.

State	Total	Value added per $100 of shipments (S.I.C. 24)	(S.I.C. 25)	(S.I.C. 26)
		(in 1982 dollars)		
Kentucky	42.93	41.27	53.15	41.98
Maryland	47.71	39.72	49.89	49.29
Ohio	43.33	43.31	53.22	40.81
Pennsylvania	45.16	42.70	54.98	43.53
Virginia	44.62	36.27	51.74	46.69
West Virginia	42.01	42.97	37.37	42.70
	(-5.7)	(-6.0)	(-29.0)	(-2.0)
	44.54	40.53	52.95	43.56

( )—percent above/below regional average
Source: [9]

Table B9

Average wage rate per production hour in the wood products industry in West Virginia and neighboring states, 1982.

	Average wage rate per production hour[a]			Percent above or below region average		
	(S.I.C 24)	(S.I.C. 25)	(S.I.C. 26)	(S.I.C. 24)	(S.I.C. 25)	(S.I.C. 26)
Kentucky	6.08	6.09	9.12	−1.6	− 6.3	− 0.5
Maryland	6.41	5.68	8.25	+3.9	−12.6	−10.0
Ohio	6.46	7.72	9.36	+4.7	+18.8	+ 2.1
Pennsylvania	6.56	7.35	9.25	+6.3	+13.0	+ 0.9
Virginia	5.76	5.35	10.03	−6.6	−17.7	+ 9.4
West Virginia	5.57	5.93	8.06	−9.7	− 8.8	−12.1
Regional average[b]	6.17	6.50	9.17			

[a] Wages expressed in dollars per hour

[b] Average based on $\frac{\text{Total Prod. Wages in Region}}{\text{Total \# Prod. Hours in Region}}$

Note: S.I.C. 24—lumber and wood products
S.I.C. 25—furniture and fixtures
S.I.C. 26—paper and allied products

Source: [9]

Table B10

Production wages expressed as a percent of value added for the wood products industry in West Virginia and neighboring states, 1982.

State	Production wages as percent of value added (S.I.C. 24)	(S.I.C. 25)	(S.I.C. 26)
Kentucky	41.3	34.5	23.4
Maryland	38.8	35.5	23.8
Ohio	34.4	32.7	33.3
Pennsylvania	35.0	31.3	23.2
Virginia	37.7	38.9	24.1
West Virginia	40.4	36.9	29.3
	36.8%	34.2	25.7

Source: [9]

Table B11

Average value of shipments per production employee in the wood products industry in West Virginia and neighboring states, 1982.

State	Average value of shipments per production employee (total)	(S.I.C. 24)	(S.I.C. 25)	(S.I.C. 26)
		in 1982 dollars		
Kentucky	44,744	26,371	32,304	77,136
Maryland	50,958	31,321	33,679	67,629
Ohio	49,937	35,766	45,694	57,406
Pennsylvania	60,278	35,522	44,615	79,951
Virginia	38,599	27,720	24,425	83,725
West Virginia	30,264 (–38.7)	24,622 (–22.2)	32,143 (–9.5)	52,000 (–27.5)
Regional average	49,386	31,652	35,535	71,758

( )—percent above/below regional average
Source: [9]

Table B12

Cost of materials expressed as a percent of value of shipments for the wood products industry in West Virginia and neighboring states, 1982.

State	Cost of materials as percentage of value of shipments (S.I.C. 24)	(S.I.C. 25)	(S.I.C. 26)
Kentucky	57.6	47.1	57.7
Maryland	59.5	53.0	51.5
Ohio	56.6	46.3	59.6
Pennsylvania	56.6	45.3	56.4
Virginia	63.8	46.8	54.4
West Virginia	57.8	64.3	56.4
Regional average	59.2	46.9	56.7

Source: [9]

Table B13

Average cost of purchased fuels and electric energy for wood products industries in West Virginia and neighboring states.[a]

Lumber and Wood Products (S.I.C. 24)

Year	WV	PA	OH	KY	VA	MD	Average	WV as percent above or below average
1977	3.62	NA	3.23	3.32	3.73	NA	3.48	+ 4.02
1978	4.21	4.42	3.86	4.00	3.92	S	4.09	+ 2.93
1979	4.39	5.17	4.76	6.00	4.49	5.22	5.30	-17.17
1980	5.00	5.89	5.48	6.78	5.57	6.00	5.69	-12.13

Furniture and Fixtures (S.I.C. 25)

Year	WV	PA	OH	KY	VA	MD	Average	WV as percent above or below average
1977	NA	NA	3.24	4.00	4.26	NA	3.83	NA
1978	D	4.10	3.44	NA	4.69	4.25	4.08	NA
1979	4.50	5.04	4.07	NA	6.07	5.33	5.04	-10.71
1980	4.00	5.73	5.00	NA	6.93	5.25	5.82	-31.27

Paper and Allied Products (S.I.C. 26)

Year	WV	PA	OH	KY	VA	MD	Average	WV as percent above or below average
1978	2.50	2.51	2.32	NA	2.23	2.11	2.34	+ 6.83
1979	D	2.93	2.80	NA	2.60	2.38	2.76	NA
1980	4.67	3.68	2.99	NA	3.40	2.79	3.34	+39.82

[a] Costs are expressed in dollars × 10^{-6}/BTU

Source: United States Department of Commerce. Annual Survey of Manufacturers. 1977-1980.

Definition of Terms

Entitlement lands—federally owned lands specifically designated as the base for computing payments in lieu of taxes. [5]

Gross state product—the current market value of goods and services produced in the state in a given year. [6]

Input-output model—an analytical tool that consists of a transactions table showing how the output of each industry is distributed among other industries and sectors of the economy in a given time period, usually a calendar year. [6]

K-V Fund—consists of monetary collections from timber sale purchasers for reforestation, timber stand improvement, and natural resource protection within timber sale areas. Established by Act of Congress on June 9, 1930 (Knutson-Vandenburg Act). [5]

Multiplier—a number, used in input-output analysis, which, when multiplied by current output, estimates the total loss/addition to economic output resulting from a given change in economic activity.

Type I multiplier—is sometimes referred to as a "simple" output multiplier since it takes into account only the direct and indirect changes in output resulting from an increase/decrease of one dollar in the output of all the industries in the processing sector. [6]

Type II multiplier—is a more realistic measure which takes into account the direct and indirect effects indicated by the input-output model *plus the induced* changes in output resulting from increased or decreased consumer spending. [6]

Payments in lieu of taxes (PILT)—annual payments made to each unit of local government in which certain federal entitlement lands are located. Authorized by Congress, Oct. 20, 1976 (Payments In Lieu of Taxes Act).

25% Fund—provides for annual payments from National Forests to individual states in the amount of 25% of all monies received through National Forest receipts, apportioned by the area in each county and to be used exclusively for public schools and roads. Established by Act of Congress in 1908 (25% Fund Act).

Value added—the conversion of the value of shipments to value of production by adding the ending inventory of finished goods and work in process and subtracting the beginning inventory. The cost of materials (including materials, supplies, fuel, electric energy, cost of resales, and cost of contract work) is then subtracted from this value of production to obtain value added. [9]

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FORESTS & THE WEST VIRGINIA ECONOMY

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Volume 2: The Timber Resource

Volume 3: The Commercial Timber Harvest in West Virginia

Volume 4: The Size and Economic Performance of West Virginia's Wood Products Industry

Volume 5: The Economic Importance of Forest-based Industries in West Virginia

Key Abbreviations

S.I.C. = Standard Industrial Classification
N.E.C. = Not Elsewhere Classified

Authors

Gary Zinn is forest scientist and Kenneth D. Jones is research technologist in the Division of Forestry, West Virginia Agricultural and Forestry Experiment Station, West Virginia University.

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Agricultural and Forestry Experiment Station
College of Agriculture and Forestry
Robert H. Maxwell, Director
Morgantown

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FOREWORD

This is the sixth in a series of reports on West Virginia's forest resources. The series examines the forest resources, their current levels of utilization, their present role in the state's economy, the outlook for the future, and the prospects for increasing the economic contribution of forests and forest-based activity for the benefit of the citizens of West Virginia.

The Forests and the West Virginia Economy series focuses mainly on timber resources and the timber-based economy. This volume will explore the basic trends and likely developments which will affect the future prospects for growth in the overall timber-based economy.

The research reported here was conducted under the auspices of the West Virginia Agricultural and Forestry Experiment Station at West Virginia University. Major financial support was provided by the West Virginia Governor's Office of Community and Industrial Development and by the Experiment Station. Other principal cooperators include the West Virginia Department of Agriculture, the USDA Forest Service, and the West Virginia Forestry Association. The investigators gratefully acknowledge the support and cooperation of these agencies and organizations.

HIGHLIGHTS

1. The U.S. consumes more wood products (70 cu. ft. per capita per year) than any other country in the world—accounting for 25 percent of world consumption. The U.S. is also the world's leading industrial source of wood products—producing 35 percent of the world's paper, 45 percent of its plywood, and 20 percent of its softwood lumber.
2. Currently the U.S. is both the world's leading producer and consumer of paper products. In 1981, approximately 62.3 million tons of paper and paperboard were produced in the U.S.; meanwhile, total U.S. paper and paperboard consumption amounted to 70.6 million tons. Forest Service projections predict total U.S. paper and paperboard consumption to increase 75 percent from 1981 to the year 2000, with a total 175 percent increase over 1981 levels by 2030.
3. Hardwood lumber consumption in the U.S. amounted to only 4.9 billion board feet in 1980, but forecasters predict that future hardwood lumber consumption will grow substantially, reaching 10.2 billion board feet by 2000 and 12.3 billion bd. ft. by 2030.
4. A new wave of reconstituted board products has been entering the marketplace at a rapid rate during the last ten years. These products can be manufactured using hardwood roundwood and residues. Most factors point to fast growth for these products in the years ahead.
5. The U.S. will not experience a shortage of timber in the foreseeable future; however, there are indications that demand for timber is rising faster than supplies, creating modest upward trends in the real prices of some timber products. The projected "gap" between supply and demand is somewhat greater for softwoods than for hardwoods.
6. The timber supply situation is considerably better in West Virginia than in the nation as a whole. Timber harvest levels in the state could easily double and still allow a net increase in growing stock volumes. Increasing demand for fine hardwoods, however, has resulted in a net loss in volume for hickory, sugar maple, and beech. Demand for select oaks and other high quality species is also high.
7. West Virginia has some promising growth and development opportunities associated with its hardwood resource, principally with hardwood lumber, composite board products, and hardwood pulp and paper products.
8. New papermaking technologies have been developed to make primary paper products from all-hardwood virgin pulp. West Virginia, therefore, can anticipate increased marketability of its hardwood roundwood and new development opportunities for both primary and secondary paper manufacturing.
9. Perhaps the greatest potential for large-scale expansion of West Virginia's wood products industry is associated with structural composite panels and fiberboard. West Virginia has the resource base capable of supporting the manufacture of these products and is also well located in relation to panel and fiberboard markets.

FORESTS AND THE WEST VIRGINIA ECONOMY

6: Growth Potential and Development Prospects for West Virginia's Timber-based Industries

Gary W. Zinn and Kenneth D. Jones

INTRODUCTION

West Virginia must look to the future if it wishes to develop that part of its economy which is based on forest resources. This future is highly uncertain, since it is difficult to accurately predict future directions in the basic economic trends which will affect forest product markets. Also, this future has many dimensions which relate to differing growth trends and prospects for various forest product markets. Since West Virginia represents only a small portion of the world's forest resource base and wood products production and marketing capability, actions taken within the state cannot be expected to significantly affect the overall resource, wood product production, and marketing situation. This does not mean, though, that the state has no control over its timber-based industrial development. In fact, expected future domestic and worldwide demands for wood products promise some substantial opportunities for timber-based economic expansion in West Virginia.

To take full advantage of these opportunities, the state must first recognize them and then must take the steps needed to attract, develop, and support the appropriate timber-based industries. Only in this way can West Virginia fully realize the economic benefits which are available through its abundant forest resources.

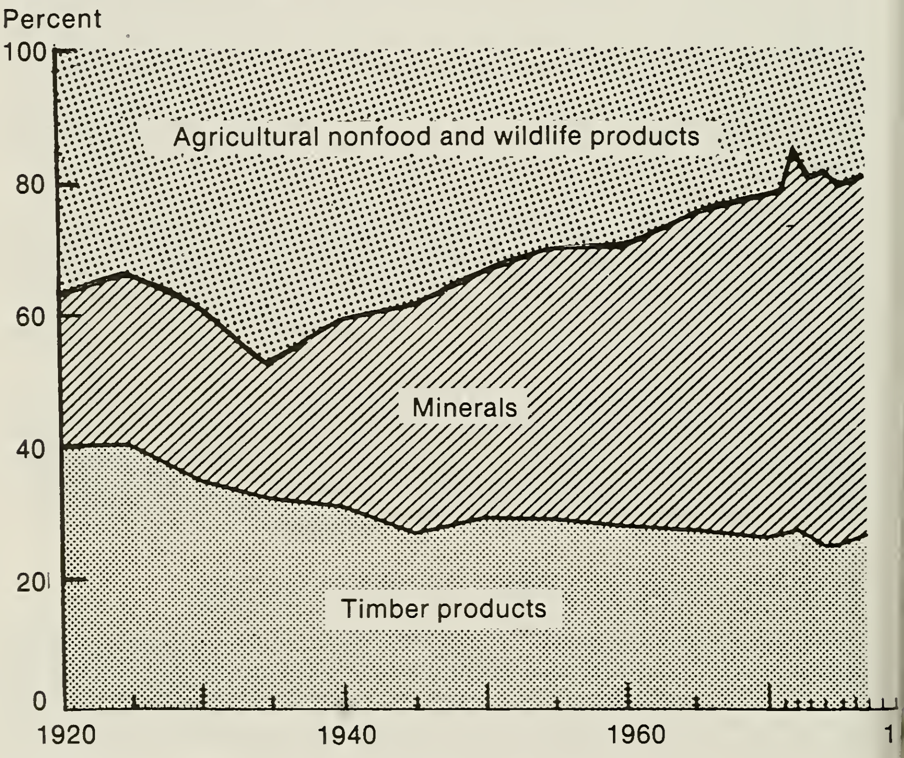
This volume of Forests and the West Virginia Economy will explore the basic trends and likely developments which will affect the future prospects for growth in the overall timber-based economy. It will discuss what these imply for growth potential in major wood product categories, and will point out which of these growth potentials West Virginia should pursue.

WOOD USE IN THE U.S. ECONOMY

Wood was once the single most important industrial raw material and chief source of fuel in the U.S. economy. But with increasing substitution and the relative lower cost of other raw materials, wood now accounts for only 26 percent of the value of major U.S. industrial raw materials and less than 1 percent of energy materials consumed (Figure 1). Despite this smaller relative role in today's economy, the total volume of wood use has increased substantially since the turn of the century. The United States now consumes more than 13 billion cubic feet of wood annually. In fact, the U.S. consumes more forest products (70 cu. ft. per capita annually) than any other country in the world—accounting for 25 percent of world consumption. The U.S. is also the world's leading industrial source of forest products—producing 35 percent of the world's paper, 45 percent of its plywood, and 20 percent of its softwood lumber [7].

In value terms, timber-based economic activity represented 4.1 percent ($48.5 billion) of the nation's gross national product (GNP) in 1972. That year, 1 of every 24 dollars of GNP originated in some type of timber-based economic activity. Of the total value added to the GNP attributable to timber in 1972, 6 percent originated from timber management, 6 percent from timber harvesting, 18 percent from primary manufacturing, 26 percent from secondary manufacturing, 25 percent from construction, and 19 percent from transportation and marketing [15].

Figure 1. Relative importance of industrial raw materials, 1920–77.



Source: [15]

As significant as the use of wood products has been in the past, their use promises to be even greater in the future. In 1984, the U.S. Forest Service projected domestic wood demand to increase rapidly with domestic roundwood consumption reaching 20.4 billion cubic feet by the year 2000 and 25.8 billion cubic feet by 2030. The majority of this increased demand will be for pulpwood [14].

World demand for wood products is also expected to increase. From 1950 to 1977, world consumption of industrial timber products rose nearly 90 percent, to 49.1 billion cubic feet [14]. With growing worldwide populations and accelerating third world development, this trend is expected to continue. To meet this demand, expanded timber production, increased manufacturing efficiency, and new wood utilization technologies will be needed. Consequently, there may be unprecedented opportunities for U.S. producers to expand forest products production to satisfy both domestic and world demands.

PROJECTED U.S. DEMAND FOR TIMBER AND WOOD PRODUCTS

Over the past 70 years, the USDA Forest Service has conducted 15 assessments of the timber situation in the United States. The last major assessment was made in the late 1970s and was last updated in 1984. These studies provide a factual basis from which a fairly reliable assessment can be made of the social, political, technological, and institutional forces influencing the present and future economic environment of the timber-based industry. Incorporated into all projections of consumption and demand is an analysis of the major supply and demand determinants for the timber and wood products sector. These basic factors include growth in population, income, and economic activity; energy costs, capital availability, and investments in forest management and utilization. In most cases, historical trends in these major determinants are assumed to extend into the projection period, thus providing a reasonable basis from which to make informed predictions.

In presenting predictions of growth poiential for wood products and in assessing what these may mean for development of West Virginia's timber-based economy, it was necessary to develop a somewhat simplified presentation of analyses presented in several recent studies [3, 5, 7, 8, 14, 15]. For clarity and consistency in the basic presentation, this report will rely primarily on the U.S. Forest Service's *An Analysis of the Timber Situation in the United States, 1952–2030* [15]. Information from other sources will be introduced into the basic presentation as appropriate.

The U.S. Forest Service [15] presents low, medium, and high level projects of wood product consumption, based on alternative assumptions about future growth in population and economic activity. Also, since the actual consumption of any product in a market economy is determined by a balancing relationship between consumer demand, product supply, and market prices, the Forest Service's projections contain built-in price assumptions. Basically, these are that future wood product prices, measured in real-dollar terms, will conform to those of the period 1950 through the mid-1970s. These are termed "base level price trends" and are used extensively in the Forest Service analysis. Since the Forest Service presents much of its analysis using medium level consumption trends and base level price trends together, these will be used herein unless otherwise noted.

Major assumptions underlying the Forest Service's timber supply and demand projections are highlighted as follows:[1]

- Latest estimates from the Bureau of the Census show continued U.S. population growth, with the total number of Americans reaching 300 million by 2030, an increase of 75 million from 1981.
- Latest projections from the Bureau of Economic Analysis indicate that real gross national product (GNP) will nearly quadruple from 1977 levels to $5.16 trillion by 2030.
- Real disposable personal income will be nearly four times larger by 2030; meanwhile, per capita income will increase three times (base year = 1977).
- Substantial and persistent increases in the cost of energy will be experienced. Although the size of the expected increases are uncertain, the prevailing upward movement of energy costs has been incorporated into the projections.
- Capital availability will not significantly constrain long-term economic growth or intensified use of forest lands and the production of timber products.
- Institutional and technological changes will continue and the effects of these changes will be similar to that recorded in historical data used in preparing the projections.

BASIC TIMBER DEMAND, SUPPLY, AND PRICE PROJECTIONS

The United States will not experience a physical shortage of timber in the foreseeable future; however, there are indications that demand for timber in general is rising faster than supplies. In a competitive economy such as that of the United States, this situation is accompanied by rising timber stumpage and wood product prices. To illustrate, in Figures 2 and 3, demand and supply of softwood and hardwood roundwood are projected using base level price trends (discussed earlier). The "gap" between demand and supply projections indicates that supply would not be sufficient to meet demand under base level price trends.[2] Since there is a gap between demand and supply under base level price trend assumptions, prices of both softwood and hardwood roundwood would be expected to increase somewhat to achieve an equilibrium level of consumption (intermediate curve in Figures 2 and 3).

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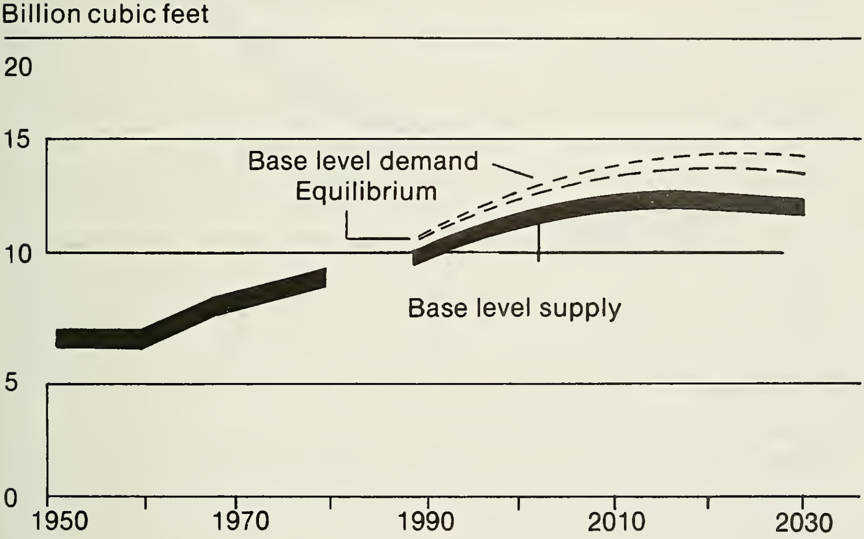
[1] See Appendix Table A1.

In 1980, total U.S. consumption of softwood roundwood amounted to 10.7 billion cubic feet. But by the year 2000, projected base level demands for softwoods from domestic forests are expected to rise to 12.8 billion cubic feet and to 15.1 billion cubic feet by 2030. Under base level price trends, however, projected supplies would not keep pace with demand, increasing to only 11.0 billion cubic feet by 2000 and 11.9 billion cubic feet by 2030 (Figure 2) [14]. The indication, then, is that softwood roundwood prices can be expected to rise significantly in the coming decades. Consequently, higher prices should moderate the demand for softwood timber and encourage the growing and harvesting of additional softwood supplies.

Figure 2. Softwood roundwood demands and supplies—domestic forests.



Source: [13]

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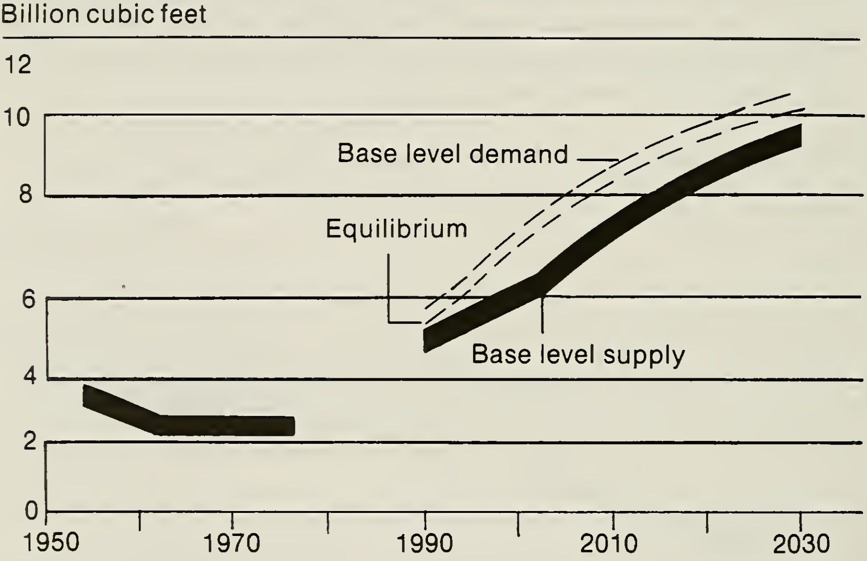
[2] Base level price trends for 1950 through the mid-1970s were that softwood and hardwood lumber prices increased by an average of 0.7 percent per year, measured in constant 1967 dollars, while there was no relative increase or decrease in the prices of plywood and paper and board products [15].

In contrast, predicted demand-supply relationships for hardwood timber are more in balance than are those for softwoods. Demands for hardwood roundwood from domestic forests are expected to rise to 7.6 billion cubic feet by the year 2000 and to 10.7 billion cubic feet by 2030—an increase of some 114 percent over 1980 levels [14]. Hardwood inventories, in general, should be sufficient to meet demands through the year 2000. Increased removals should then bring rising hardwood stumpage prices and a fall in equilibrium consumption levels of hardwoods (Figure 3).

Figure 3. Hardwood roundwood demands and supplies—domestic forests.



Source: [13]

The supply and demand situation for preferred hardwood species of high quality, however, is somewhat different. Already there has been considerable pressure on supplies of fine hardwoods such as select white and red oak, walnut, hard maple, and black cherry. Sharp increases in stumpage prices for these hardwoods have already occurred and are expected to continue [15].

For West Virginia, the timber supply situation is considerably better than that of the U.S. as a whole. For several decades timber removals have been well below levels of annual growth. As a consequence, timber inventories, especially of hardwoods, have been rising at rapid rates. Harvest levels in West Virginia could easily double and still allow a net increase in growing stock volumes. Increasing demand for West Virginia's fine hardwoods, however, has resulted in a net loss in volume for hickory, sugar maple, and beech. Demand for select oaks and other high quality preferred species is also high. Although annual growth of select white and red oaks and black cherry is still greater than annual removals, there is upward pressure on stumpage prices for these species.

GROWTH POTENTIAL FOR MAJOR WOOD PRODUCTS

The prospects for growth in any wood products industry depend on a multitude of economic variables, including the general economic climate, the availability of raw materials, capital, and labor, efficient production facilities, and perhaps most important, a dependable, growing market for its products. Insight may be gained into the wood product industry's growth prospects by examining past trends in consumption of basic wood products—lumber, plywood and panels, and pulp, paper, and fiber—and also by studying reasoned projections of future consumption of these products.

Lumber-based Industry

In the United States total lumber consumption has been fairly stable for several decades. Consumption was 40.9 billion bd. ft. in 1950 and decreased slightly, to 39.5 billion bd. ft. by 1970. During the 1970s, U.S. lumber consumption grew to a peak of 51.0 billion bd. ft. in 1978 (Figure 4), but then tailed off to 37.3 billion bd. ft. in 1982, showing the effects of the recession of that time [12].

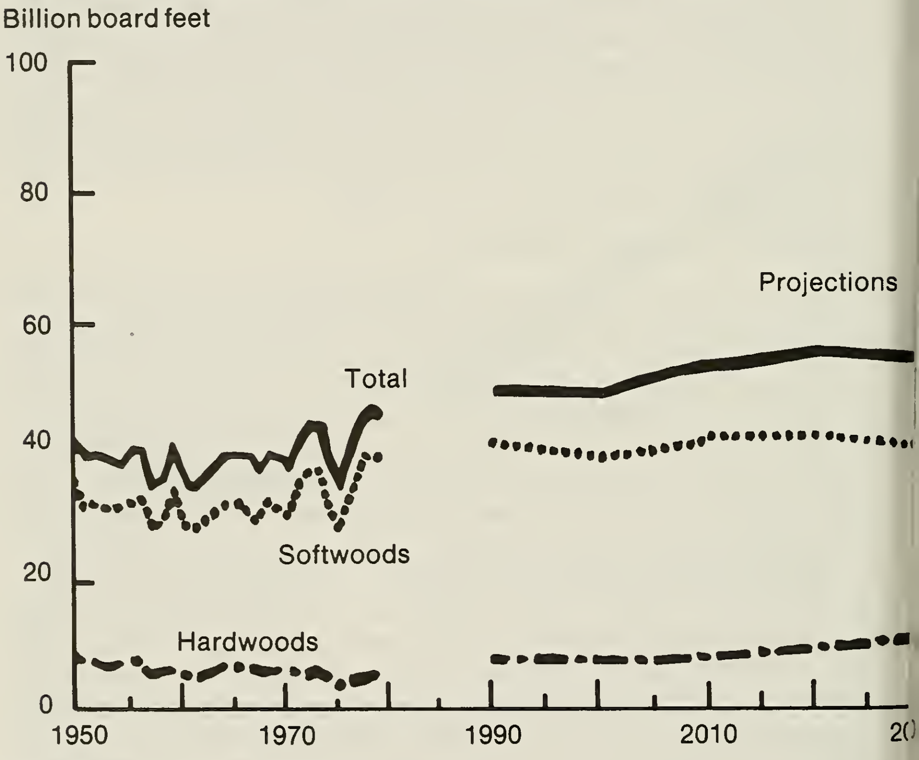
U.S. Forest Service forecasters expect an upward consumption trend for future decades. Under assumptions used in the Forest Service's 1983 Assessment Supplement, total U.S. lumber consumption is expected to increase to 52.1 billion bd. ft. by the year 2000 and to 57.7 billion bd. ft. by 2030 [3].

Hardwood lumber consumption in the U.S., which peaked at 8.0 billion bd. ft. in 1966, amounted to only 4.9 billion bd. ft. in 1980—13 percent of total lumber consumption that year [12]. Major end uses for hardwood lumber are in the manufacturing and shipping industries. Increasing hardwood lumber consumption from these industries, especially in pallet and furniture manufacturing, lead forecasters to predict that future hardwood lumber consumption will grow substantially, reaching 10.2 billion bd. ft. by 2000 and 12.3 billion bd. ft. by 2030 [3]. In addition, hardwood lumber exports have grown 2.5 times since 1977 to 500 million board feet in 1983. About 66 percent of hardwood lumber exports go to Canada and most of the remainder to Europe [12].

Prior to the recession of the early 1980s, West Virginia's sawmills produced about 400 million bd. ft. of lumber per year, much of which was used or exported green or air dried. The majority of the state's high quality lumber is exported to furniture manufacturers in the Northeast and the South Atlantic states. During a 12-month period in 1982–83 West Virginia shipped more than

117 million board feet of furniture lumber to these manufacturers and ranked as the fourth largest supplier to the furniture industry in North Carolina [11]. That total was approximately one half of all lumber produced in the state during that time. Most of the remaining lumber produced in West Virginia is used in rough construction, wood pallets and skids, mine timbers, railroad ties, and shipping containers. Very little lumber from West Virginia is exported directly overseas.

Figure 4. Lumber consumption, 1950–79, with projections to 2030.



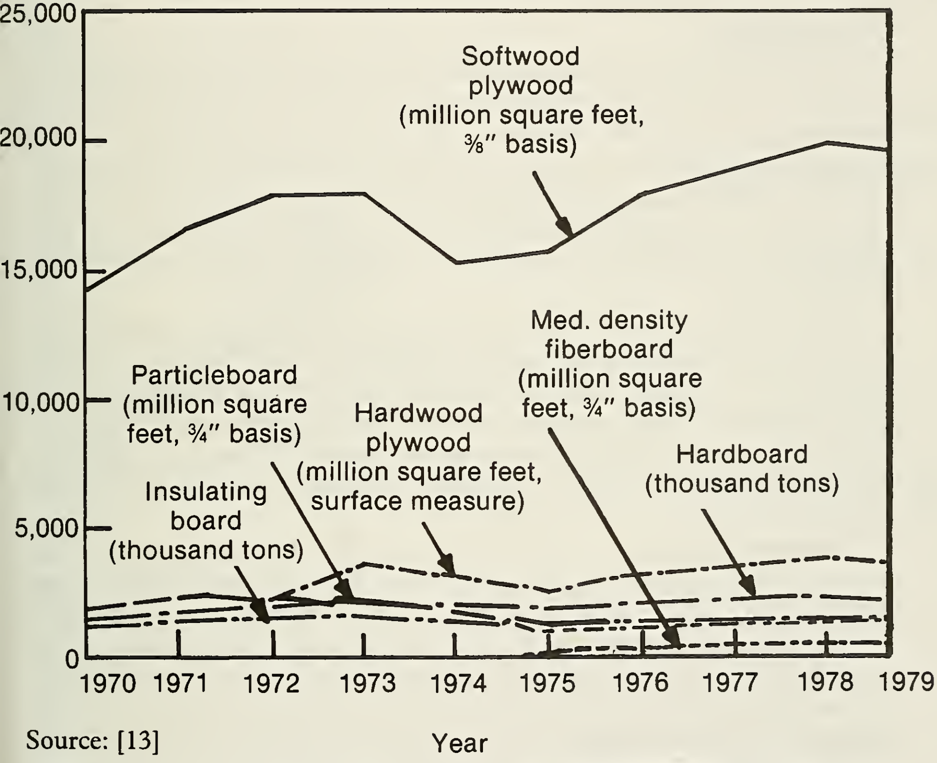
*Base level price trends

Source: Historical data from [15]; projections from [3]

Plywood and Panel Products

Over the last several decades plywood and similar panel products have been replacing lumber in many construction applications. Consumption trends indicate that per capita use of lumber declined while per capita use of plywood and veneer rose from 2.3 cu. ft. in 1950 to 7.0 cu. ft. in 1979. During the same period, use of panel products increased almost sevenfold. In addition to plywood, a variety of wood panels are now competing in the construction and manufacturing sectors. However, in 1979 unveneered panel products accounted for only 1.5 percent of the demand for structural panels (Figure 5). And even though this percentage is expected to increase dramatically by 1990, plywood probably will continue to be the major structural panel product used in the U.S. for another 10–20 years [8].

Figure 5. Historical production of major panel products, 1970–79.



Source: [13]

Basically, there are four types of panel products (1) plywood, (2) structural composite panels, (3) particleboard, and (4) fiberboard. Plywood and structural composite panels are used primarily in construction, while the principal application for particleboard and fiberboards are in furniture manufacturing and other non-structural uses. The future product mix of these four panel types will depend greatly on relative production costs, raw material availability, and market acceptance.

Currently there are no plywood or panel manufacturers in West Virginia, but recent developments in the industry make the state an attractive location for such enterprises. In an effort to increase utilization of mill wastes and low quality hardwoods, and to reduce raw material costs, the wood industry has developed improved panel production technologies. Panel products such as particleboard, waferboard, and oriented strand board can now be made from cheaper, more available low quality roundwoods. West Virginia has a vast supply of this material and is located near major eastern population centers and construction markets. The potential for West Virginia to meet the future requirements of this growing industry is tremendous.

PLYWOOD

Plywood is the oldest of these panel products, and has been replacing lumber in construction for the past three decades. Plywood is a flat panel made of laminated, crossbanded wood veneers, with the grain of adjacent layers at right angles to each other. The manufacturing process consists of two stages: veneer production and the layup and gluing of the veneers into plywood. Although many plywood mills are now capable of using some hardwood species and smaller logs, most plywood is manufactured from high quality, large diameter softwood logs.

The majority of plywood consumed in the U.S. is used for roof and wall sheathing, and flooring in new housing construction. New residential construction accounts for almost half of softwood plywood consumption. An additional 12–25 percent is consumed in residential upkeep and repair. Hardwood plywood, which comprises only about 20 percent of total U.S. plywood production, is used mainly for interior wall panels and in mobile home construction [15].

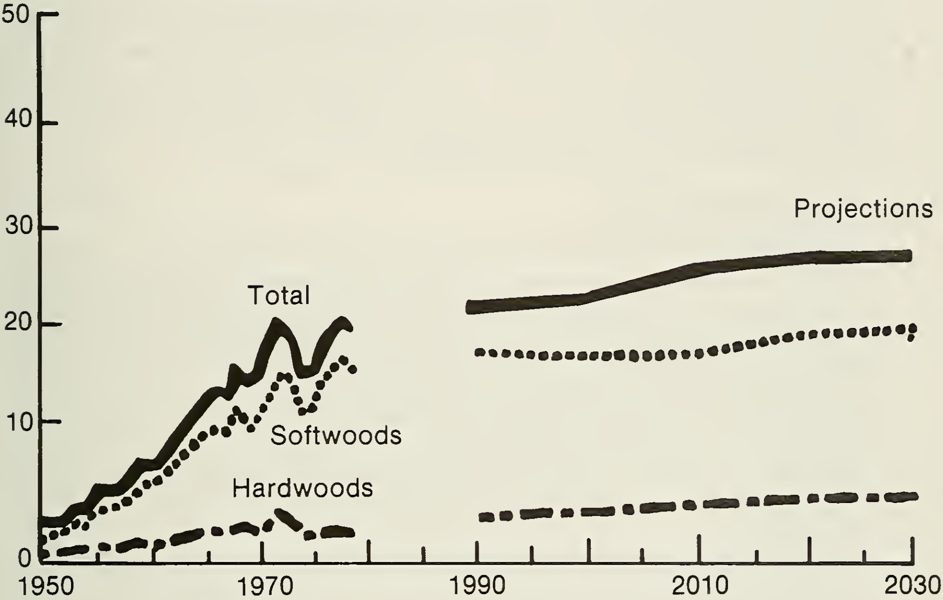
The general production trend for softwood plywood was upward during the 1970s—averaging 3 percent per year. In fact, softwood plywood, as well as total plywood production, set new records in 1977 and 1978 before declining in more recent years due to low levels of housing construction and competition from newer composite panels. By 1982, softwood plywood capacity was 44 percent greater than actual production. Meanwhile, hardwood plywood fared no better as production declined 45 percent from 1973–1983 (Appendix Table A2) [9].

Analysis of long-term trends seem to indicate that most of the substitution of plywood for lumber has already occurred and that plywood itself will probably suffer future losses in construction use to other recently developed panel products. Plywood producers will be forced to change product mixes or to compete directly with the new panel products. In the latter event, manufacturing costs will determine the future success and relative market share of plywood panels. Nevertheless, it is predicted that increasing population demands will cause total plywood consumption to rise from 20.5 billion sq. ft.

in 1976 to 25.2 billion sq. ft. by 2000 and to 28.1 billion sq. ft. by 2030. Although hardwood plywood consumption fell during the 1970s, renewed growth is predicted to the year 2000 (about 2.3 percent per year) with more modest growth thereafter (Figure 6) [3].

Figure 6. Plywood consumption, 1950–79, with projections* to 2030.

Billion square feet (⅜-inch basis)



*Base level price trends

Source: Historical data from [15]; projections from [3]

STRUCTURAL COMPOSITE PANELS

Between 1970 and 1978, the producer price index for softwood plywood tripled, due in part to rapidly rising softwood stumpage prices [2]. In response to this increase in raw material costs the wood products industry sought to increase production capacity and market acceptance of panel products made from small-sized trees, underutilized species, and wood manufacturing residues. This effort resulted in a promising new segment of the wood-based panel industry—structural composite panels.

Structural composite panels are manufactured using wood particles—e.g., chips, flakes, wafers, and strands—which are pressed into a flat panel and bonded with a thermo-setting adhesive [8]. These panels have several production and marketing advantages: (1) they are functionally competitive with sheathing-grade plywood and can be easily substituted for lumber, plywood and certain non-wood materials in many uses; (2) they can be produced in a variety of lengths, widths, and thicknesses for special applications; and (3) they can be made from less expensive hardwood raw materials.

Presently numerous composite panel products are being developed or just entering the U.S. market. Three of these—waferboard, oriented strand board, and veneer-faced composite-core panels have done or are expected to do very well in the marketplace. Unfortunately, these products are so new that consumption data is not yet available to establish trends for projection. However, most factors point to continued fast growth for structural composite panels in the years ahead. Since that is the case, a brief discussion of the various structural composite panels is appropriate.

WAFERBOARD

Waferboard, or flakeboard, is a panel made from wood wafers or large, flat flakes. It is more durable, more resistant to moisture, high temperatures, and weathering than particleboard and is functionally competitive with plywood in many construction applications. Historically, most waferboard has been made from species with low specific gravity such as aspen, pine, spruce, and fir; but research has now greatly expanded the range of species suitable for waferboard production. One species now widely accepted as suitable for waferboard production is yellow poplar. West Virginia, with its tremendous supply of yellow poplar, should be in an ideal position to benefit from this new technology.

Since waferboard has been around since the late 1950s it has a slight advantage over newer panel products: it has already achieved market acceptance, its technology and product quality are proven, and production costs are known. Waferboard capacity is expanding and the industry is beginning to locate in the Appalachian region in order to be closer to the major construction markets of the east coast and to take advantage of previously underutilized hardwood resources. Louisiana-Pacific Corporation recently constructed a waferboard plant in western Virginia. It has a capacity of 90 million sq. ft. per year and became operational in 1985. The site was chosen because of its proximity to reliable raw material sources, key waferboard markets, and because of Virginia's favorable business climate. The history of waferboard capacity in North America is shown in Table 1.

Table 1.

Waferboard capacity in the United States and Canada, 1957–1981.

Year	U.S. Capacity	Canadian Capacity
1957	25	—
1961	25	40
1969	25	190
1972	105	190
1975	105	590
1979	90	800
1980	90	1050
1981	550	1275

NOTE: Capacity is ⅜″-basis in millions of sq. ft. per year
Source: [10]

ORIENTED STRAND BOARD

Further research and development in structural panels led to the recent introduction of oriented strand board (OSB). OSB is made from wood strands (usually length is three times width) that are formed into a mat of 3–5 layers. Each layer is aligned perpendicular to adjacent layers. This crossbanded construction gives OSB superior strength properties compared to waferboard and other composite panels. Raw material requirements are similar to that of waferboard in that low density hardwood roundwood can be used. Total U.S. production of OSB in 1984 was more than 500 million sq. ft., ⅜-inch basis [10].

Most OSB plants are located in the north central states and Canada where they have a dependable supply of aspen and spruce. However, OSB manufacturing facilities are beginning to appear in southern and eastern U.S. because of favorable raw material and market locations there.

Much of the technology developed for waferboard is transferable to OSB. Additionally, it is possible to "engineer" OSB to meet differing requirements by varying resin content, strand size, density, and orientation. In 1983, Georgia-Pacific announced plans to build ten OSB facilities, including plant locations in North Carolina, Virginia, and Mississippi. A feasibility study completed in 1983 concluded that a moderate size OSB facility in Elkins, West Virginia was an economically viable opportunity [1].

OTHER STRUCTURAL PANELS

The new wave of reconstituted board products has been entering the market during the last ten years at a rapid rate. Some of the more widely accepted panel products include Com-ply, Eco-board, and new varieties of plywood made from cypress and red gum. Many of the new panels are made using particleboard or OSB cores with veneer faces. Com-ply and Eco-board are among these veneer-faced composite-core panels. The panels have similar properties to plywood but require two separate processes during manufacture and thus lose much of the cost advantage of other composite board products. Because of this they are not likely to compete as well as waferboard and OSB.

Particleboard

As its name implies, particleboard is made by blending wood particles, chips, and sawdust with adhesives and wax. The mixture is then formed into a mat and hot-pressed to the desired thickness. The resulting "boards" are then cut and trimmed to desired dimensions. About 50 percent of all particleboard produced is consumed by furniture corestock and cabinet manufacturing industries. Particleboard is also used in floor underlayment in housing construction, but it is generally considered to be a nonstructural panel.

After peaking at 3.7 billion sq. ft. in 1978, U.S. particleboard production dropped to 3.1 billion sq. ft. by 1984—slightly less than 1974 production levels (Appendix Table A2). The poor economy during the recession of the early 1980s explains some of the decline, but some could be attributed to other underlying negative trends of a serious nature.

During the early 1970s, sawmill residues were the principal source of particleboard raw material. These residues were readily available and relatively inexpensive. The cost of adhesives was also low. But increasing competition has resulted in fewer available wood residues and increased prices for both residues and adhesives. Consequently, production costs and raw material availability began to be an area of increasing concern to particleboard manufacturers.

Perhaps the greatest challenge to growth in the particleboard industry, however, comes from newer panel products like medium density fiberboard, which offers superior strength and woodworking properties and competes directly in traditional particleboard markets. As a result, continued growth in the particleboard industry will depend on its ability to remain cost competitive with other panel products.

Fiberboard

Fiberboard, insulation board, and hardboard are generally manufactured from wood fiber rather than from wood particles. Fiberboards are not generally used in load-bearing applications because they tend to be less stiff than other panels of similar density. Although the U.S. hardboard industry has been growing at a slow but steady rate, there have not been any recent major technological developments in the fiberboard field with the exception of medium density fiberboard (MDF).

MDF began to establish itself in the 1970s and is beginning to replace particleboard in many furniture applications. It has a very smooth surface with tight edges and can be routed and molded like solid wood. In addition to furniture use, MDF will probably also find acceptance for use in interior paneling, trim, door jambs, and casegoods.

Production of MDF has almost quadrupled over the last ten years (Appendix Table A2) and many industry people expect MDF markets will continue to expand significantly during the next decade.

Pulp, Paper, and Paperboard

The record of paper products production and consumption in the United States has been one of brisk, steady growth. Currently, the U.S. is the world's leading producer and consumer of paper products. In 1981, approximately 62.3 million tons of paper and paperboard were produced in the U.S. (roughly 35 percent of world output) with paper products accounting for about 50 percent of production [7]. Meanwhile, total U.S. paper and paperboard consumption in 1981 amounted to 70.6 million tons [5].

Between World War II and 1981, consumption of all paper products increased at an average annual compounded rate of 3.2 percent. U.S. Forest Service medium level projections predict total U.S. paper and paperboard consumption to increase 75 percent from 1981 to the year 2000, with a total 175 percent increase over 1981 levels by 2030 (Figure 7) [15].

Consumption of paper alone amounted to 39.0 million tons in 1981 and is predicted to achieve significant growth—reaching 57.4 million tons by the year 2000 and 78.7 million tons by 2030 [5, 15].

It is projected that consumption of paperboard will also increase substantially. In 1981, 31.8 million tons of paperboard were consumed in the U.S. [5]. Consumption is expected to rise to 54.7 million tons by 2000 and to 88.6 million tons by 2020—increases over 1981 levels of 73 percent and 180 percent, respectively [15]. Paperboard is used primarily in packaging and is one of the most rapidly expanding product areas of the paper industry.

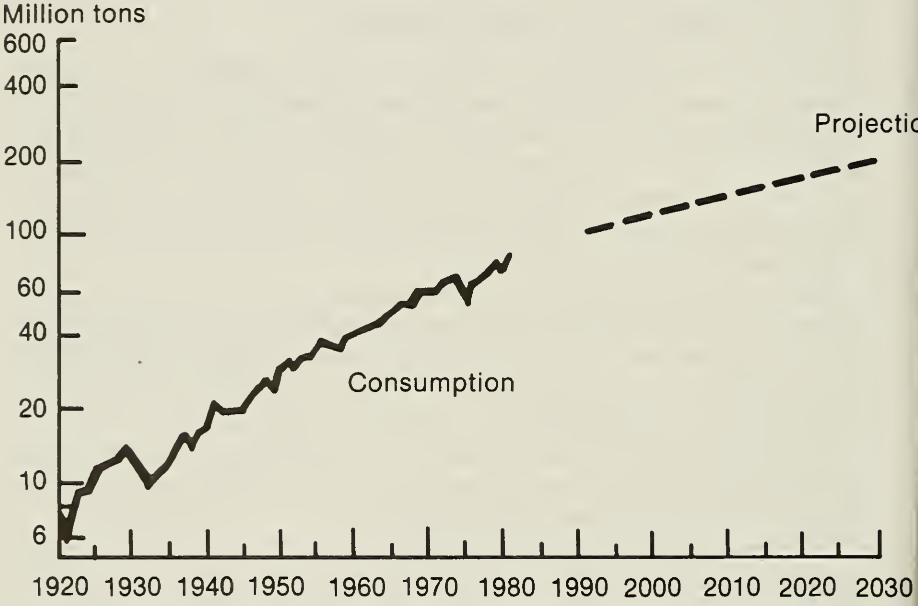
To meet the raw material demands of the paper industry in 1981, the U.S. produced a total of 79.7 million cords—an increase of 18 percent over 1970 production levels. Sixty-four percent of total pulpwood production was from roundwood while 38 percent was from plant byproducts (residues) [5]. Increasing competition for wood residues from wood fuel consumers and reconstituted wood product plants, however, will probably result in a smaller percentage of residues being used to manufacture paper in the future.

Hardwood pulpwood accounted for roughly 27 percent of total pulpwood production in 1981. But recent changes in papermaking technology permit greater volumes of hardwood fiber in the woodpulp mixture. Demand for domestic hardwood pulpwood, therefore, is expected to more than double to

34.5 million cords by the year 2000 and to quadruple to 59.8 million cords by 2030.

Total demand for pulpwood in the U.S. is expected to increase to 129.7 million cords by the year 2000 and to 179.4 million cords by 2030—an increase of over 125 percent from 1981 (Figure 8) [15].

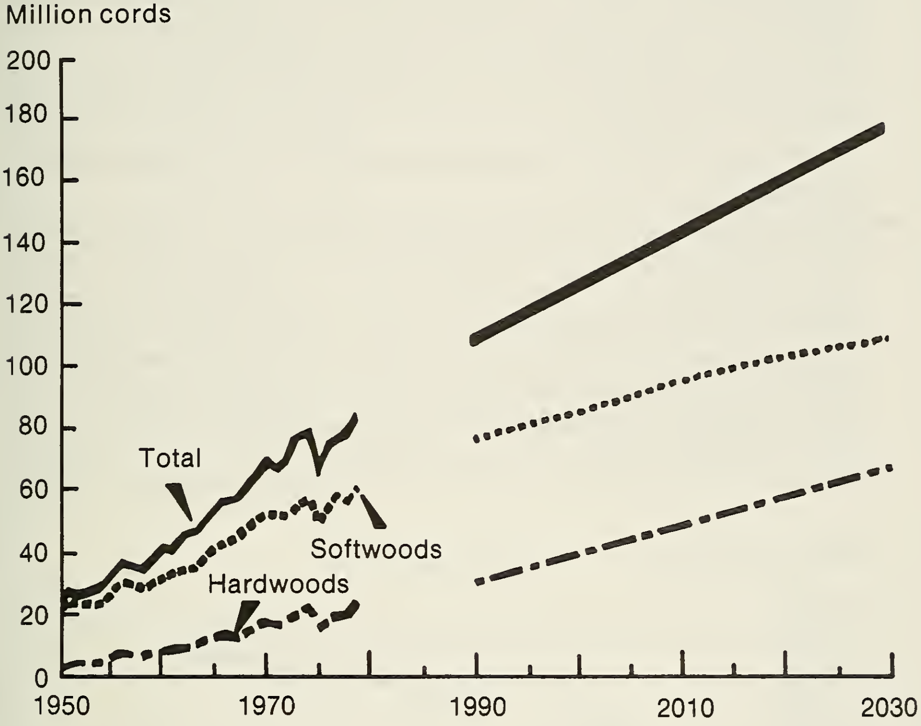
Figure 7. Paper and paperboard consumption in the United States, 1920–1981; with projections to 2030.



Source: [13]

In light of these impressive growth expectations for the pulp and paper industry, West Virginia can well anticipate increases in the marketability of its hardwood roundwood for pulp and paper manufacture. In the past, establishment of primary papermaking facilities in West Virginia was infeasible due to the absence of sufficient softwood raw material, the close proximity of established mills, and the large capital investment necessary for such an operation. However, new papermaking technologies which produce certain paper and paperboard products entirely from hardwood fiber, or a combination of unprocessed hardwood fiber and recycled paper, may open new opportunities for primary papermaking in West Virginia.

Figure 8. Pulpwood consumption in U.S. mills, 1950–79, with projections* to 2030.



*Base level price trends

Source: [13]

Also, opportunities exist for secondary paper products manufacture, already a major component of the state's forest industry that has the added advantage of producing good economic benefits—high wages, value added, and sales value per unit of input [4]. Moreover, the capital cost of a new secondary paper conversion plant is relatively small when compared to a primary facility. Any opportunity to increase secondary paper processing in the state, therefore, should be cultivated.

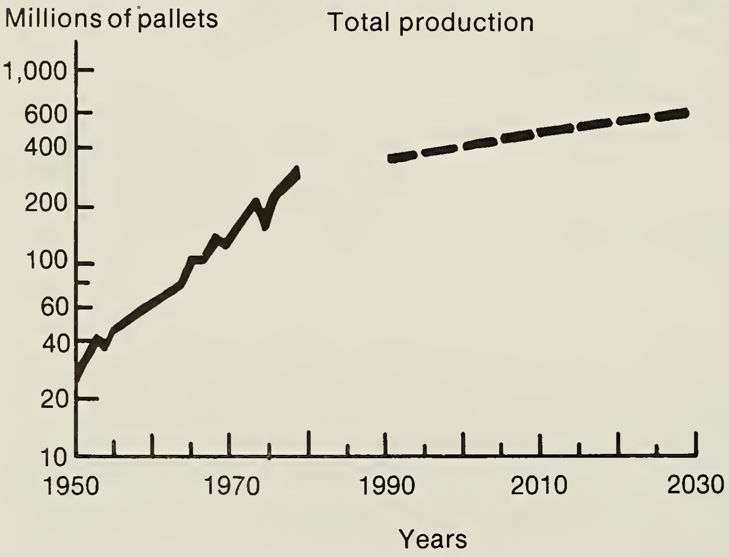
Miscellaneous Industrial Wood Products

Aside from the major wood products previously discussed, there are a variety of miscellaneous wood products produced and consumed in West Virginia and the U.S. which are of some significance. Among these are pallets, mine timbers, fencing, treated pilings, poles and posts, log homes, hardwood flooring, cooperage, etc. Combined, these products account for a significant percentage of total wood consumption nationwide. In 1978, the volume of wood used in all miscellaneous wood products exceeded 6 billion bd. ft. [15]. More importantly, these products can often be made from underutilized or low quality wood material. Manufacturing these products as a secondary product line or as a byproduct can improve the versatility and profitability of individual mills.

PALLETS

Pallet production is the single largest non-construction use of lumber in the United States, accounting for approximately 14 percent of all lumber consumed in the U.S. in 1980. That year more than 5.4 billion board feet of lumber (mostly hardwoods) was used to make an estimated 258 million pallets [5]. Pallet production is expected to increase almost 66 percent from 1980–2000, and is predicted to consume 9 billion board feet of lumber by the turn of the century (Figure 9) [15]. With this in mind, West Virginia sawmill

Figure 9. Pallet production in the U.S., 1950–79, with projections to 2030.



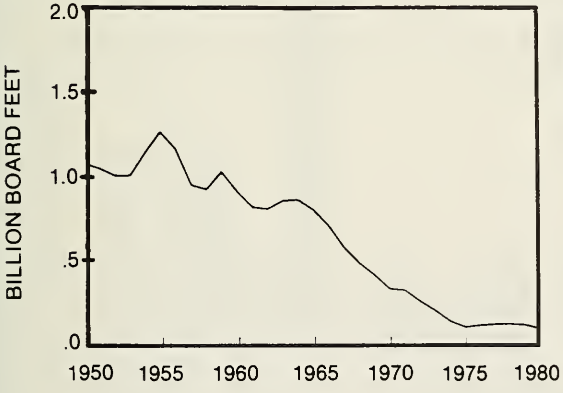
Source: [13]

owners would be wise to cultivate pallet markets for their low-grade lumber or to diversify into pallet manufacturing should an opportunity arise. However, pallet manufacture is a venture which should be undertaken carefully, for pallet markets are highly competitive and profit margins are small. Because of the small profit margins, pallets are usually produced in close proximity to end users. Skillful marketing, though, may provide the key to a successful pallet enterprise.

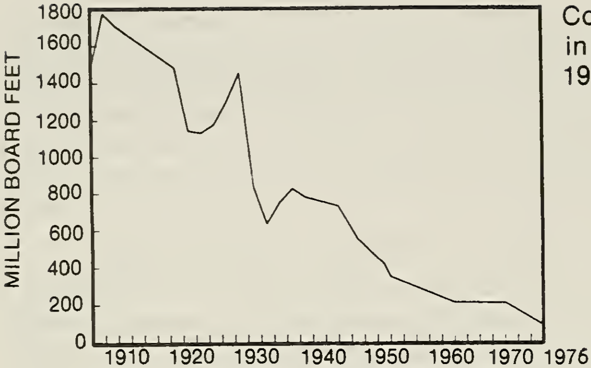
OTHER MISCELLANEOUS WOOD PRODUCTS

Railroad ties, fence posts, house logs, mine timbers, boxes, bolts and chemical wood are all products which can usually be produced from low-grade material at most sawmills around the state. Total nationwide consumption of these products amounted to an estimated 380 million cubic feet in 1978 and projections are for slow growth into and beyond the year 2000. Although national trends for many of these products have been downward for some time (Figure 10), there is often enough local or regional demand to suggest diversification into miscellaneous timber products. Product diversificaiion could strengthen an individual mill's market position, especially during times of low demand for other product lines.

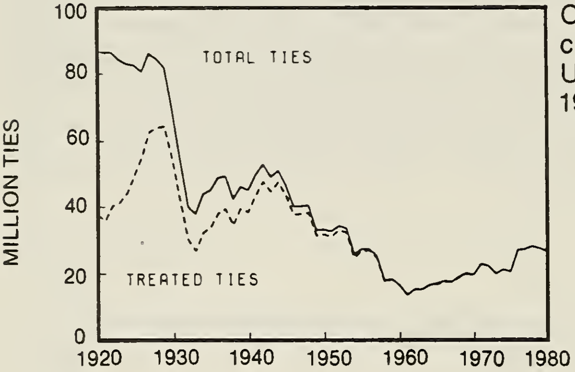
Figure 10. Consumption of miscellaneous wood products in the U.S.



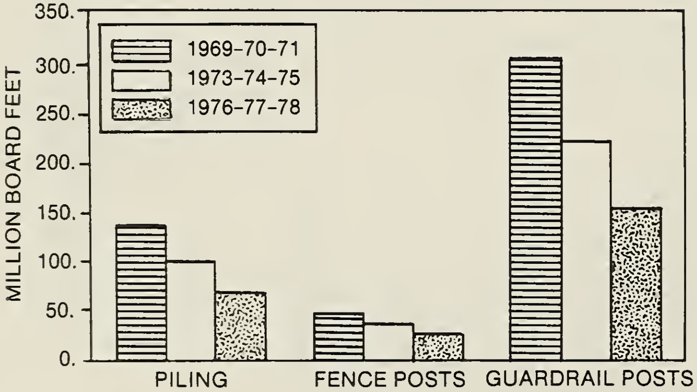
Hardwood flooring production in the United States, 1950-1980. (ML 84 5094)



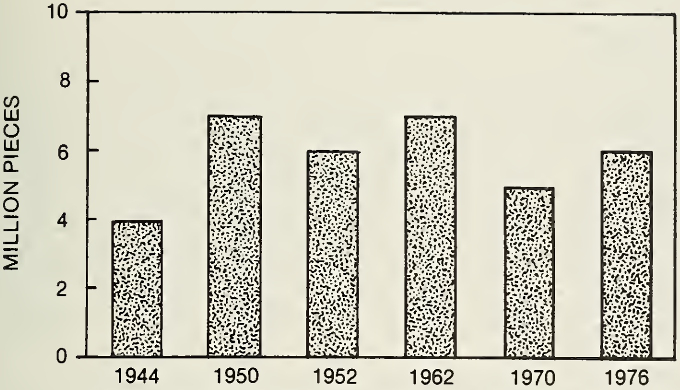
Cooperage consumption in the United States, 1906–1976. (ML84 5095)



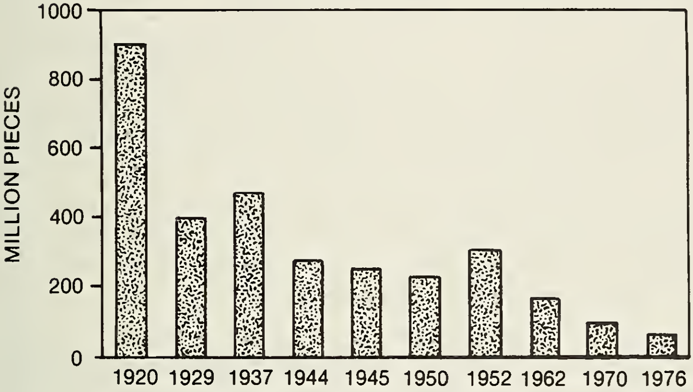
Cumulative crosstie consumption in the United States, 1920–1980. (ML 84 5096)



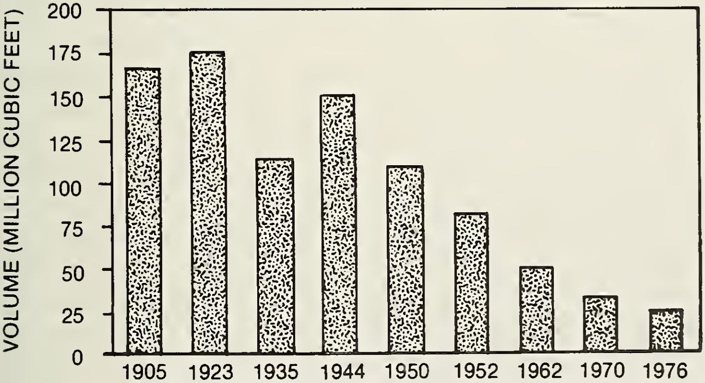
Post and piling use in highway construction in the United States (3-year averages), 1969-1978. (ML 84 5099)



Pole consumption in the United States, selected years, 1944-1976. (ML 84 5100)



Fencepost consumption in the United States, selected years, 1920-1976.



Mine timbers consumed in the United States, selected years, 1905-1976. (ML 84 5098)

DISCUSSION OF FOREST SERVICE PROJECTIONS

The reader is cautioned that all projections, including those presented above, are subject to interpretation and qualification based on one's own view of the future. The Forest Service projections are based on intense study of past trends in the nation's economy and its timber-based sector and incorporate many consensus assumptions concerning likely future trends and developments. Still, they should be viewed as no more or less than estimates of the most likely futures, given the assumptions on which they are based. As such, they are subject to valid criticism, with alternative views of the future timber situation also being worthy of consideration.

Thus, it is important to recognize some of these criticisms in this discussion. For instance, the following points were made in a recent report by the U.S. Congress's Office of Technology Assessment (OTA) [7]:

> [T]here is reason to doubt that the Forest Service projections are accurate. More than likely, Forest Service forecasts of timber demand are overstated. Future domestic demand for wood products probably will grow, but it is unlikely to reach the projected levels unless there is a major upturn in the housing market or government intervention to stimulate wood fuel use. Conversely, the Forest Service forecasts of timber supply are conservative, particularly on forest industry lands, and probably underestimate the ability and willingness of landowners to increase timber production.

The OTA critique goes on to suggest that Forest Service estimates of future timber needs for housing and fuelwood are "probably too optimistic," that "Forest Service forecasts of future timber supply probably underestimate the productivity of U.S. forests," and that "the role of changing technology in stretching the wood resource also is treated conservatively" in Forest Service assessments [7].

In response to various criticisms of their projections, Forest Service analysts recently prepared a special report which contains several scenarios based on different sets of assumptions regarding demand and supply determining variables [3]. One, titled the "low growth in timber markets simulation," represents a relatively conservative outlook on timber demand-supply relationships, compared with the basic assumptions underlying the Timber Situation Analysis [15] and the Assessment Supplement [14]. Major assumptions underlying this simulation include (1) housing start figures considerably lower than those assumed in the Timber Situation Analysis and the Renewable Resource Supplement, (2) increased exports of U.S. wood products over those in the earlier two analyses, (3) significantly higher improvements in product yield for softwood lumber and plywood, and (4) fuelwood consumption levels near those of the Timber Situation Analysis.[3] Overall, these assumptions "generally represent a future in which high interest rates reduce the demand for housing and solid wood products. They would not, however, result in a reduction of demands for those products, such as pulp and paper, that are a function of general economic activity" [3].

The low growth in timber markets scenario results in sharply lower levels of total softwood lumber consumption by the year 2030—from a projected 46.5 billion board feet in the Assessment Supplement to about 42 billion board feet, almost 10 percent less [3]. Other substantial effects of this simulation are that "[r]eal softwood lumber price grows at a rate of .75 percent per year over the 1980–2030 period versus 1.31 percent per year in the Assessment Supplement. Growth in delivered wood costs in all regions is moderated. . . . In the aggregate, the outlook portrayed in this simulation is one of reduced economic scarcity for wood products. The associated lower prices would tend to stimulate export markets" [3].

Interestingly, this simulated view of the future does not greatly change earlier Forest Service projections concerning the outlook for hardwood timber resources and products. The greatest change under the Low Growth in Timber Markets simulation is a reduction of hardwood lumber production of some 14 percent below that projected in the Assessment Supplement for the year 2030. Also, hardwood lumber prices would be moderated by somewhat less than 10 percent by 2030 under this scenario, as compared with those projected in the Assessment Supplement. One reason for this result is that all of the simulations done in this study included an assumption that, in the foreseeable future, hardwoods would be substituted for softwoods wherever technically feasible. "This substitution is partially motivated by abundant supplies and low current costs of hardwoods in eastern regions. Further technical developments in pulp and paper production, reconstituted wood panels, and nonstructural solid wood applications may provide the opportunity for more substitution of lower cost hardwoods" [3].

Results from the various simulations in Haynes and Adams lead Forest Service Analysts to conclude that [3]:

> All of the simulations that were run indicate that the Nation is faced with the prospect of continuing real increases in stumpage prices for most species and sizes of timber, and in the prices of most timber products. These increases will very likely be the largest for softwood sawtimber; high quality hardwood sawtimber of preferred species; and the products, mainly lumber and plywood, made from

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[3] A more thorough explanation of the assumptions underlying the "low growth in timber markets" simulation may be found in source [3], p. 41.

> this timber. . . . The simulations have shown that it takes large changes in the assumptions about the demand-or-supply determinants to significantly alter the price outlook described in the Assessment Supplement.

One final criticism of the Forest Service's Timber Situation Analysis and related Assessment Supplement is that neither report used data more recent than 1980. The baselines for the projections, then, did not reflect the recession of 1980–82. Consequently, the Forest Service projections for the 1980s immediately proved to be far too high; this prompted critics of the Forest Service to question the validity of the overall projections. But long-term economic projections in general are notorious for being inaccurate for individual years or short groups of years; a much fairer test is whether they are generally accurate in trend over longer spans of time. Hopefully, the use of more complete data and more refined economic models will improve the accuracy of the latest Forest Service projections. Regardless of the exact direction of future timber trends, most analysts generally agree that growing populations and new technologies will create some promising opportunities for development in the timber and wood products industries.

PURSUING GROWTH POTENTIALS

The preceding examination of production and consumption trends of major wood products has identified several areas which offer the greatest potential for future expansion and economic growth in West Virginia'a timber-based industry. West Virginia is predominantly a hardwood state and thus it is no surprise that promising growth and development opportunities are primarily associated with its hardwood resource, principally with hardwood lumber, composite board products, and hardwood pulp and paper products. In addition, much potential is also evident in the area of secondary wood products manufacture, especially allied paper products. Further exploration of these target areas is appropriate.

Hardwood Lumber

The hardwood lumber industry is the dominant wood products industry in the state. It shipped more than $101 million dollars worth of lumber and related products in 1982 [11]. Given the projected growth in hardwood lumber consumption levels, it is reasonable to assume that existing enterprises will increase production and expand capacity to meet demand. If the state's hardwood lumber industry just matched the predicted levels of annual growth for this industry, West Virginia's sawmills would be increasing annual production by only 3 percent per year. Greater growth could be realized, however, if the industry could increase lumber and product value, and increase both in-state and out of-state marketing capabilities. The sawmilling industry could also benefit by diversifying into secondary product lines such as dimension stock and pallets.

Increases in lumber value can result by continuing to emphasize maximum grade recovery from sawlogs and mill lumber. Optimum grade recovery can depend on many little things, including sorting and grading of logs, log breakdown to maximize grade, artful trimming and edging of raw boards, and proper stacking and drying techniques. New technologies such as Best Opening Face (BOF) and Saw-Dry-Rip (SDR) also hold potential for increasing grade recovery [14].

The expansion of lumber kiln-drying capacity in the state also has the potential to increase lumber values. Currently, West Virginia kiln dries less than 25 percent of its lumber production compared to 60 percent nationwide. It has been pointed out that "sawmill operators who do not kiln dry their lumber are foregoing potential profits on sale of their higher grade lumber and cannot gain access to potential markets where kiln dried lumber is in demand" [14]. A recent survey indicated that there is a definite market for at least an additional 17 million board feet of kiln dried lumber within West Virginia [5]. Development of a larger and more stable kiln drying industry would certainly be a step towards increasing secondary wood products manufacture in West Virginia.

Increased product value can also be obtained by using lower grade lumber to manufacture higher value products such as furniture blanks and pallets. New production technologies including shaper lathe headrigs and mills using the "System 6" process are designed to do just that. The key point of all these production designs is that they are purposefully planned to utilize low-grade logs to produce a marketable product at a profit. The products are those for which markets exist or briskly growing markets are foreseen.

Furniture Blanks

Traditionally, high-quality hardwood lumber has been used to make the solid wood parts in high-value products such as furniture and kitchen cabinets. However, there is a shortage of high-quality trees in the hardwood forests and a surplus of small-diameter, low-quality trees. These lower-quality trees can now be sawn into furniture and cabinet parts using new technology to produce a new product, standard-size blanks. This technology, known as "System 6" was developed by Forest Service reaearchers at the Forestry Sciences laboratory in Princeton, West Virginia. With this technology, low-grade hardwood logs can be converted into furniture blanks through a process of custom sawing, drying, and gluing. If standard-size blanks gain market acceptance, this process would increase the profitable utilization of low-quality hardwoods. Thus, it holds much potential for West Virginia's forest industry.

Composite Wood Products

Perhaps the greatest potential for large-scale expansion of West Virginia's wood products industry is associated with structural composite panels and fiberboard, particularly with waferboard, oriented strand board, and medium density fiberboard. As noted earlier, these industries have tremendous growth prospects within the very near future. And West Virginia is not only well located in relation to the primary markets, but has a resource base capable of supporting the manufacture of these products.

The industry has just begun to move into the eastern and southern hardwood region as technological advances have allowed it to utilize a greater number of light to medium density hardwood species. Yellow poplar and red maple would be particularly suitable for use in these products. Leading firms in the industry, including Louisiana-Pacific and Georgia-Pacific, have already undertaken multiple-plant programs and have recently located facilities in Virginia and North Carolina. Industrial development concerns in West Virginia will have to move quickly and aggressively, if the state is going to capitalize on this new era of panel products.

Pulp, Paper, and Secondary Paper Products

Secondary paper product manufacturing is of great economic importance to West Virginia. The 25 secondary paper product firms operating in West Virginia in 1982 comprised only 6 percent of all wood industry establishments in the state, but produced $48 million in value added—30 percent of value added in the state's entire wood products industry. Because secondary paper processing adds so much value and because there are primary paper manufacturing facilities so near at hand, West Virginia is in an ideal position to benefit from the expected growth in this segment of the industry.

Highlighting this projected growth is a constant influx of new and different paper products for use in both new and existing markets. Innovative products have made use of advanced methods for surface treatment, impregnation, flame proofing, and moisture resistance and have been successful in competing against plastics and other substitutable non-paper products. In fact, steady growth is forecasted for a variety of specialty products such as coated papers and advanced packaging systems, as well as for products made from paper/plastic combinations. Recent successes in the area of liquid packaging illustrate how the use of plastics can increase paper's usefulness and marketability.

Investment in even a small secondary paper products manufacturing facility has a good chance of realizing some very substantial economic benefits including greater employment and value added. Therefore, any interests toward expanding this segment of the state's wood products industry should be encouraged.

As noted earlier, new papermaking technologies have been developed to make primary paper products from all-hardwood virgin pulp. One firm making such products has already shown some interest in West Virginia for a mill location; if similar opportunities arise in the future they should be cultivated.

Secondary Wood Products Manufacture in General

Finally, the economic benefits of increasing the overall level of secondary wood products manufacture in West Virginia should be stressed. From a structural and economic contributions viewpoint, the great weakness in the state's wood products industry is that it is dominated by harvesting and primary manufacturing activities, with relatively little secondary manufacturing of primary products. This means that West Virginia is not realizing the full potential of its timber resource to produce more jobs, greater income from wood product sales, increased business tax revenues, etc.—all of which contribute to the state's economic well-being.

Heavy emphasis should thus be placed on developing a healthy secondary wood products industry in the state. Priority should be on promoting both secondary industries which utilize primary products (notably hardwood lumber) and those which might be based on promising new primary industries—i.e., composite wood products and hardwood paper products. In summary, the economic contribution of West Virginia's abundant timber resource will not be realized until its secondary wood products industry is much more fully developed.

CONCLUSION

Future growth of the state's wood products industry is likely to occur as a natural response to increasing demands. But the real growth potential of the state's timber industry is not in gradual increases in production to serve gradually expanding raw material and primary product markets. Rather, it lies through a coordinated effort aimed at (1) producing higher valued products from the state's primary wood industries; (2) developing and implementing an effective marketing program for the state's wood products; and (3) aggressively pursuing wood product manufacturing facilities which are suitable for location in West Virginia. The success of such an effort would result in a stronger, more diversified timber-based industry capable of a much greater economic contribution to the state's economy.

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APPENDIX A

Table A1.

Population, gross national product, and disposable personal income in the United States, specified years 1929–79, with projections to 2030.

Year	Population		Gross national product		Per capita gross national product		Disposable personal income		Per capita disposable personal income	
	Millions	*Annual rate of change*	*Billion 1972 dollars*	*Annual rate of change*	*1972 dollars*	*Annual rate of change*	*Billion 1972 dollars*	*Annual rate of change*	*1972 dollars*	*Annual rate of change*
1929	121.8	—	314.6	—	2,583	—	229.8	—	1,886	—
1933	125.7	0.8	222.1	-8.3	1,767	-9.1	169.7	-7.3	1,350	-8.0
1940	132.6	.8	343.3	6.4	2,589	5.6	244.3	5.3	1,849	4.6
1945	140.5	1.2	560.0	10.3	3,986	9.0	338.6	6.7	2,420	5.5
1950	152.3	1.6	533.5	-1.0	3,503	-2.6	361.9	1.3	2,386	- .3
1955	165.9	1.7	654.8	4.2	3,947	2.4	425.9	3.3	2,577	1.6
1960	180.7	1.7	736.8	2.4	4,077	.7	487.3	2.7	2,697	.9
1965	194.3	1.5	925.9	4.7	4,765	3.2	612.4	4.7	3,152	3.2
1970	204.9	1.1	1,075.3	3.0	5,248	1.9	741.6	3.9	3,619	2.8
1971	207.1	1.1	1,107.5	3.0	5,348	1.9	769.0	3.7	3,714	2.6
1972	208.8	.8	1,171.1	5.7	5,609	4.9	801.3	4.2	3,837	3.3
1973	210.4	.8	1,235.0	5.5	5,870	4.7	854.7	6.7	4,062	5.9
1974	211.9	.7	1,217.8	-1.4	5,747	-2.1	842.0	-1.5	3,973	-2.2
1975	213.6	.8	1,202.3	-1.3	5,629	-2.1	859.7	2.1	4,025	1.3
1976	215.2	.7	1,273.0	5.9	5,915	5.1	891.8	3.7	4,144	3.0
1977	216.9	.8	1,340.5	5.3	6,180	4.5	929.5	4.2	4,285	3.4
1978	218.7	.8	1,399.2	4.4	6,398	3.5	972.5	4.6	4,447	3.8
1979[1]	220.6	.9	1,431.6	2.3	6,490	1.4	995.3	2.3	4,512	1.5

					Low projections					
1990	236.3	.7	1,940	3.2	8,210	2.5	1,360	3.2	5,760	-2.5
2000	245.9	.4	2,410	-2.2	9,800	1.8	1,690	2.2	6,870	1.8
2010	250.9	.2	2,940	2.0	11,720	1.8	2,060	2.0	8,210	1.8
2020	253.0	.1	3,410	1.5	13,480	1.4	2,390	1.5	9,450	1.4
2030	249.3	-.1	4,000	1.6	16,040	1.8	2,800	1.6	11,230	1.7
					Medium projections					
1990	243.5	.9	2,070	3.7	8,500	2.8	1,450	3.7	5,950	2.8
2000	260.4	.7	2,690	2.7	10,330	2.0	1,880	2.6	7,220	2.0
2010	275.3	.6	3,440	2.5	12,500	1.9	2,410	2.5	8,750	1.9
2020	290.1	.5	4,190	2.0	14,440	1.5	2,930	2.0	10,100	1.4
2030	300.3	.3	5,160	2.1	17,180	1.8	3,610	2.1	12,020	1.8
					High projections					
1990	254.7	1.2	2,200	4.2	8,640	2.9	1,540	4.2	6,050	2.9
2000	282.8	1.1	3,010	3.2	10,640	2.1	2,110	3.2	7,460	2.1
2010	315.2	1.1	4,050	3.0	12,850	1.9	2,840	3.0	9,010	1.9
2020	354.1	1.2	5,180	2.5	14,630	1.3	3,630	2.5	10,250	1.3
2030	392.8	1.0	6,700	2.6	17,060	1.5	4,690	2.6	11,940	1.5

[1] Preliminary.

Note: Annual rates of increase were calculated for the various periods indicated, except for the 1990 projections which were derived from the 1977 trend level ($1,290 billion) for the gross national product.

Sources: Population: U.S. Department of Commerce, Bureau of the Census. *Population estimates and projections.* Curr. Pop. Reps. Ser. P-25. 1929–69—"Estimates of the population of the United States and components of change: 1940 to 1978." No. 802, 1979. 1970–79—"Estimates of the population of the United States to October 1, 1980." No. 894, 1980. Projections—"Projections of the population of the United States: 1977 to 2050." No. 704, 1977.

Gross national product: Council of Economic Advisers. 1929–79—*Economic report of the President.* January 1980. Projections, Medium—U.S. Department of Commerce, Bureau of Economic Analysis. Unpublished data. Projections, Low and High—U.S. Department of Agriculture, Forest Service.

Disposable personal income: Council of Economic Advisers. 1929–70—*Economic report of the President.* January 1980. Projections—U.S. Department of Agriculture, Forest Service.

Source: [13]

Table A2.
U.S. Panel Production, 1974–1984.

			(thousand ft^2)		
Year	Structural panels (⅜-in. basis)	Particleboard (¾-in. basis)	Hardboard (⅛-in. basis)	MDF (¾-in. basis)	Hardwood plywood (surface measure)
1974	15,878,380	3,103,800	6,056,542	—	1,644,043
1975	16,050,180	2,538,934	6,237,906	215,496	1,279,592
1976	18,440,000	3,202,225	7,066,022	280,036	1,463,135
1977	19,376,000	3,592,910	7,200,000	441,354	1,478,000
1978	19,964,000	3,720,369	7,800,000	508,416	1,480,571
1979	19,653,000	3,376,488	7,687,798	506,728	1,434,521
1980	16,468,000	2,949,897	6,140,000	493,140	1,312,000
1981	17,023,000	2,869,352	6,104,000	516,102	1,270,220
1982	16,402,554	2,393,066	5,586,918	448,157	1,162,600
1983	20,821,342	2,919,544	7,302,702	605,098	1,289,900
1984	21,967,917	3,100,000 (est.)	6,837,118	650,000 (est.)	1,300,000 (est)

Source: *Forest Industries*, April, 1985.

APPENDIX B

Definition of Terms

Best Open Face (BOF)—Computer program, developed at the U.S. Forest Products Laboratory, that determines the optimum sawing pattern to use on a log to maximize its lumber yield.

Disposable Personal Income—That part of a person's income remaining after deducting personal income taxes.

Furniture Blanks—Rough-dimension, wooden parts that meet certain quality specifications. They may be solid or glued together and are used in furniture and cabinet manufacture.

Gross National Product (GNP)—The total monetary value of all final goods and services produced in a country during one year.

Growing Stock—Live trees of commercial species that are classified as sawtimber, poletimber, saplings, and seedlings; that is, all live trees of commercial species except rough and rotten trees.

Hardwoods—Dicotyledonous trees, usually broadleaved and deciduous.

Medium Density Fiberboard—A non-structural panel composed of wood fibers held together by glue. It has extremely flat, smooth surfaces and edges which can be easily worked to make molding and furniture parts.

Oriented Strand Board (OSB)—Flat, structural panel made with aligned strand or ribbon shaped pieces of wood, sometimes crossbanded (strands in different layers oriented perpendicular to adjacent layers), sometimes veneered.

Paperboard—A composition board consisting of several layers of different pulp stock laid down to form a thicker sheet.

Particleboard—Any of various composition boards formed from small particles of wood, such as flakes or shavings, bonded together with a resin. Generally, a non-structural panel.

Plywood—An assembly of three or more layers of veneer joined together with glue and usually laid with the grain of adjoining layers at right angles.

Roundwood—Logs, bolts, or other round sections cut from trees; can also refer to standing trees.

Saw-Dry-Rip (SDR)—A process that allows greater use of hardwoods for lumber manufacture by reducing their tendency to warp and deform. Involves drying a squared log before sawing it into separate pieces of lumber.

Softwoods—Coniferous trees, usually evergreen, having needles or scalelike leaves.

Waferboard—Flat structural panels made with wafers or large flat chips of wood glued and pressed together; generally used in structural sheathing.

FORESTS & THE WEST VIRGINIA ECONOMY

Volume 7: The Business Climate for Forest-based Industries in West Virginia

Bulletin 691—Volume 7, April, 1987
Agricultural and Forestry Experiment Station
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West Virginia Forest Development Series

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Previously released volumes in The West Virginia Forest Development Series

Forests and the West Virginia Economy

Volume 1:	Forest Land Base, Forest History and Types, Forest Ownership and Inventory
Volume 2:	The Timber Resource
Volume 3:	The Commercial Timber Harvest in West Virginia
Volume 4:	The Size and Economic Performance of West Virginia's Timber-based Industry
Volume 5:	The Economic Importance of Forest-based Industries in West Virginia
Volume 6:	Growth Potential and Development Prospects for West Virginia's Timber-based Industries

Authors

Kenneth D. Jones is research technologist and Gary W. Zinn is forest scientist in the Division of Forestry, West Virginia Agricultural and Forestry Experiment Station, West Virginia University.

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Agricultural and Forestry Experiment Station
College of Agriculture and Forestry
Robert H. Maxwell, Director
Morgantown

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FOREWORD

This is the seventh in a series of reports on West Virginia's forest resources. The series examines the forest resources, their current levels of utilization, their present role in the state's economy, the outlook for the future, and the prospects for increasing the economic contribution of forests and forest-based activity for the benefit of the citizens of West Virginia.

The Forests and the West Virginia Economy Series focuses mainly on the timber resource and the timber-based economy. Although observations on other forest resources are included, these are not examined in detail. This particular volume discusses the business climate for forestry in West Virginia by examining the strengths and weaknesses of related social and economic infrastructural components in the state.

The research reported here was conducted under the auspices of the West Virginia Agricultural and Forestry Experiment Station at West Virginia University. Major financial support was provided by the West Virginia Governor's Office of Community and Industrial Development and by the Experiment Station. Other principal cooperators include the West Virginia Department of Agriculture (Division of Forestry), the USDA Forest Service, and the West Virginia Forestry Association. The investigators gratefully acknowledge the support and cooperation of these agencies and organizations.

HIGHLIGHTS

1. West Virginia must contend with a reputation, be it imagined or real, of having a relatively unattractive climate in which to do business.
2. The business climate for forest-based industries in West Virginia is somewhat better than the state's business climate as a whole, but there are some deficiencies evident in its supporting infrastructure and business laws which discourage major forest-based investments in West Virginia.
3. Considerable improvement has been made in West Virginia's transportation system over the last 15 years, but the state still suffers from an underdeveloped interstate highway system and a backlog of needed state road maintenance and repairs.
4. Difficulty in obtaining financial resources to support entrepreneurial activity has often been mentioned as a major obstacle confronting the start-up of new enterprises in West Virginia. In 1985, West Virginia had the lowest per capita amount of outstanding commercial and industrial loans in the nation—$311 per person, while the national median was $947.
5. West Virginia's business tax structure has been described as being extremely complicated and frustrating for business both in and outside the state. However, in 1985 the state legislature passed the State Tax Reform on Businesses Act which will hopefully encourage business formation and expansion.
6. West Virginia's wood products industry is not characterized by the high percentage of union membership and corresponding high wages found in other manufacturing and extraction-based industries in the state.
7. Union membership in West Virginia's wood products industry is only 15.3 percent as compared to the 38.3 percent unionization rate found in the state's manufacturing sector as a whole. Union membership in primary wood-using industries is even less at 4.9 percent.
8. Wage rates per production hour in the wood products industry are lower in West Virginia than in any of its neighboring and competing states.
9. Only one work stoppage was documented in West Virginia's wood products industry during the past two years—a clear indication of the industry's labor stability.

FORESTS AND THE WEST VIRGINIA ECONOMY

The Business Climate for Forest-Based Industries in West Virginia

Kenneth D. Jones and Gary W. Zinn

INTRODUCTION

Expected future domestic and world-wide demands for wood products promise some substantial opportunities for timber-based economic expansion in West Virginia. The state has abundant hardwood timber resources with the potential to double its current level of utilization without eroding its forest resource base. Additionally, West Virginia has a well-developed and experienced primary wood industry capable of increasing its production if given the markets and incentives to do so. West Virginia also is well located with relation to the large population centers and consumer markets of the eastern U.S. and has access to several major ocean ports capable of facilitating exports of wood products. With these advantages in mind, the prospects for growth in the state's wood products industry seem to be most promising.

But there are additional, non-forestry related factors which affect the prospects for development of West Virginia's wood products industry. Forest products companies are, in most respects, like any other business. They are subject to many business problems such as unstable markets, high production costs, overcapacity, and the "merger mania" that has taken hold in the U.S. Managers of forest product concerns have also had to develop strategies to compete with foreign as well as domestic competitors. The success or failure of these strategies, however, is often determined by the ability of the state to provide a favorable and profitable environment in which to do business.

West Virginia has had to contend with a reputation, be it imagined or real, of having a relatively unattractive climate in which to do business. In light of this negative impression, an examination of the state's social and economic infrastructure is appropriate in order to determine the state's strengths and weaknesses, to dispel unsound criticisms, and to identify those deficiencies which need to be addressed in order to provide a secure and fertile environment in which timber-based businesses can grow and prosper.

What constitutes a strong and competitive business climate? There are certain sociological and physical requirements needed to support industrial activity. These necessities are referred to as a state's infrastructure and unless these fundamental requirements are in place and adequately maintained, industrial development cannot or will not occur.

BASIC COMPONENTS OF WEST VIRGINIA'S INFRASTRUCTURE

"Regional economists generally agree that there are certain conditions which are necessary for a state's economy to grow or develop, or even to maintain the status quo. Collectively these are referred to as a state's infrastructure and consist of the following: (a) an adequate transportation system; (b) an adequate labor supply with the necessary skills; (c) readily available sites for commercial and industrial structures; (d) a sufficient supply of acceptable process water; (e) a satisfactory system of public education; and (f) the availability of cultural and recreational amenities" [9].

There are some additional factors which also have important effects on the state's business climate. These include comparative labor costs, comparative energy costs, capital availability, and governmental factors; i.e., taxes, regulations, and the attitude and level of support for business. Some of these factors are measurable, others can only be evaluated subjectively. There is little doubt, however, that West Virginia does possess a number of readily available commercial sites, more than ample supplies of water, and sufficient recreational opportunities; but doubts arise when the adequacy of the state's transportation system, labor force, and educational system are examined.

The Transportation System

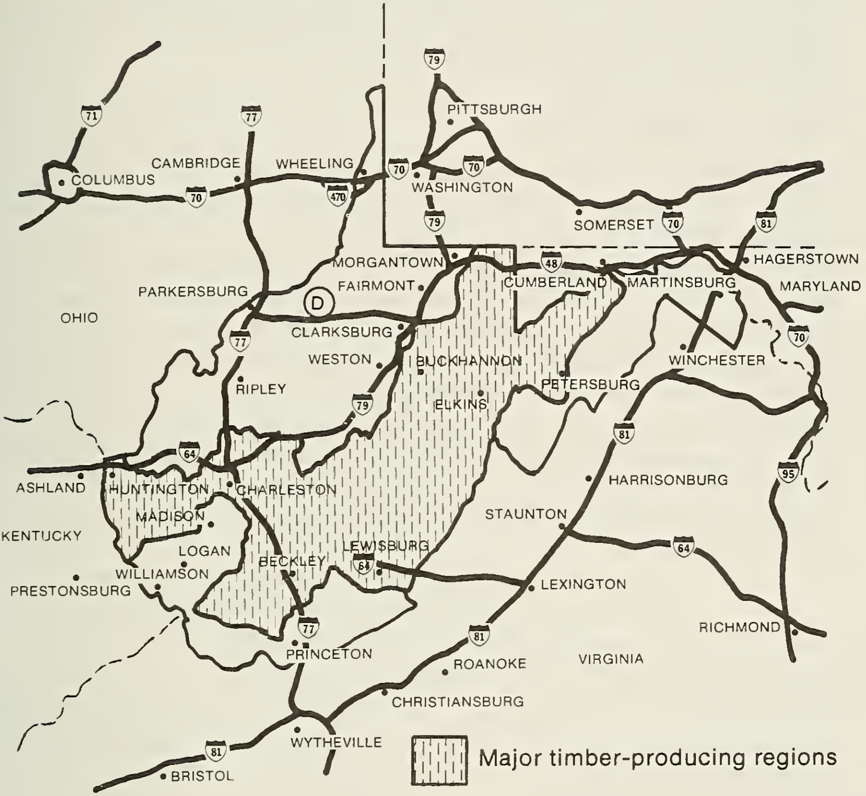
West Virginia is a mountainous state with topography that hinders the movement of raw materials and manufactured goods within and across its borders. Although West Virginia has a fairly extensive rail network and several navigable river systems, most movement of timber and wood products is by truck. Because of this, the adequacy of the state road system takes on added importance for the state's wood products industries.

Timber, even in manufactured form, is a bulky commodity with perhaps half of the cost of finished lumber being derived from transportation costs alone [19]. Without a modern, well-developed road network, West Virginia wood products firms suffer a cost disadvantage when moving timber and wood products around the state, particularly in the heavily timbered eastern and southern regions.

By itself, West Virginia does not represent a large market for hardwood lumber and other wood products; rather, the state's present and future role is as a supplier of rough and finished hardwood products. The major markets for these products lie to the east, southeast, and northwest of the state. Without reliable access to these markets the state will continue to be at a disadvantage.

Prior to the 1970s, there was not a single modern interstate highway serving West Virginia. Even now large sections of the state are without direct access to major interstate arteries, including some areas which are highly suitable to wood industry location (Figure 1).

Figure 1. Location of interstate highways serving West Virginia in relation to major timber-producing regions in the state, 1986.



Although considerable improvement has been made in West Virginia's transportation system over the last 15 years, the state still suffers from an underdeveloped interstate highway system and a backlog of state road maintenance and repairs. According to a recent report, almost half of the bridges in West Virginia are structurally deficient or functionally obsolete and more than one third of these bridges are posted with reduced weight limits [19]. This is extremely detrimental to an industry which must transport heavy materials. Even with federal highway funds, West Virginia has not been able to complete its Appalachian Corridor system as planned. In the 1986 state budget the Governor requested a $750 million bond issue to finance completion of this system. The commitment of long-term funding, principally for the repair and maintenance of secondary roads and bridges and unfinished interstate connections would go a long way towards alleviating the transportation problem. Regardless of the outcome of this highway funding proposal, the transportation difficulties experienced by the wood industry and other extractive industries will continue for some time. The number, location, and condition of secondary roads and bridges, as well as the existence of interstate connections, is an extremely important part of the state's infrastructure. In its present condition the transportation system must be considered to have a major negative impact on business in West Virginia.

The Labor Force

West Virginia is perceived throughout the rest of the U.S. as having a poor labor climate. Improvements in labor-management relationships, however, are changing the stereotyped opinions regarding the stability and productivity of labor in West Virginia. West Virginia, for example, has the lowest percentage of manufacturing working time lost over the past two years due to work stoppages involving 1,000 or more employees [1]. The employee acquisition and subsequent profitable operation of the aging Weirton Steel Works has also been a nationally recognized labor-management achievement. This is not to suggest that trouble spots do not remain—indeed some of these are serious—but the generalization of the state's labor force as being uniformly poor is not accurate. Broad measures of West Virginia's labor force do, however, raise some serious concerns (Table 1).

Table 1
Labor force characteristics in West Virginia and rank among the fifty states, 1985.

Measure	W.Va.	U.S.	Rank
Population (1980)	1.95 mil	226.5 mil	34th
Population/sq. mile (1980)	81	64.0	25th
Civilian labor force (1983)	772,000	111.5 mil.	34th
Civilian employment-population ratio (1985)	44.4	59.5	50th
Unemployment (1985)	15.0	7.5	1st
Workers compensation pay (1982)	$211.7 mil.	——	18th
Level of unionization (1984)	34%	23%	5th
Avg. annual pay (1983)	$16,863	$17,542	23rd
Avg. weekly earnings of production workers (1984)	$400.2	$373.2	12th
Avg. hourly earnings of production workers (1984)	$9.93	$9.17	12th
Personal income/capita (1984)	$9,848	$12,707	47th
Avg. annual change in personal income (1980-84)	.5%	3.3%	49th
Persons below poverty level (1979)	15%	12.4%	12th

Source: [5, 13, 14]

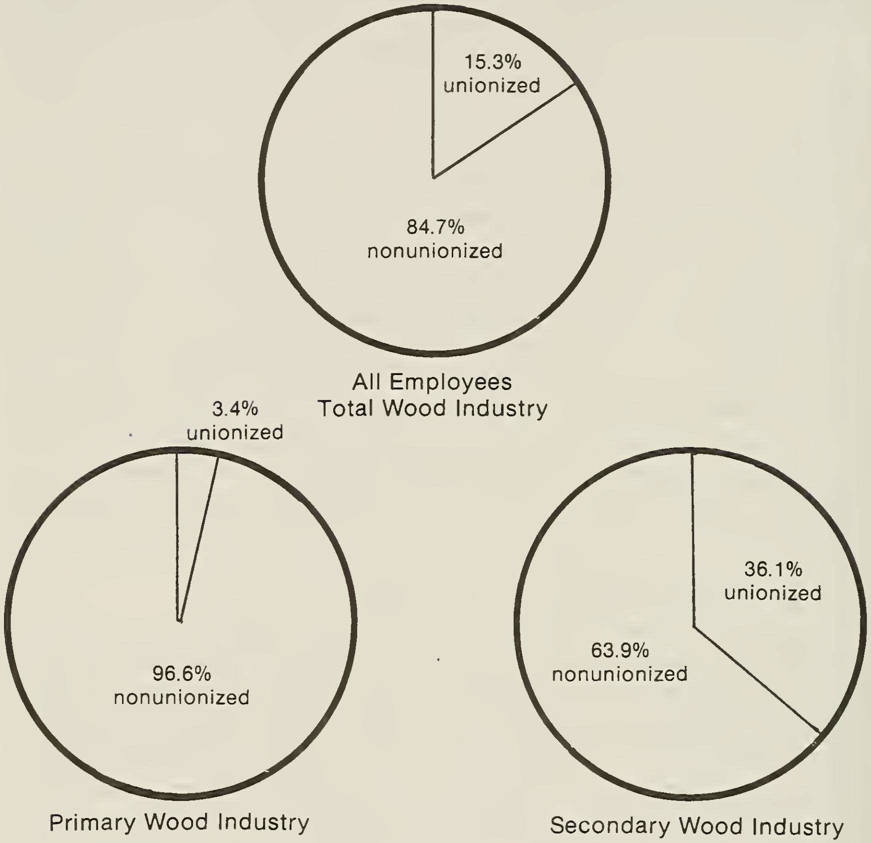
West Virginia is a rural state, especially for the eastern U.S., and this is plainly apparent in its relatively low population and population density. In turn, fewer people mean fewer workers. The state's civilian labor force ranks only 34th in size among all the states. Historically, businesses have viewed this as a negative factor due to their concern for being able to attract a sufficient number of workers. There is, however, a recent trend of new factories being built in underpopulated areas, where labor is generally cheaper [15]. West Virginia may be able to capitalize on this trend and capture some additional economic benefit from its rural workforce.

Unemployment is another factor often reviewed by prospective businesses. Although chronic high unemployment may be viewed by some as a negative characteristic, it may also be seen as evidence of an ample supply of available workers. Whatever the perception of outside concerns may be, however, high unemployment is not viewed in a positive sense by state residents or state officials. The duration and size of West Virginia's recent high unemployment (70,700 jobless persons or 9.8 percent of the workforce as of December 31, 1985), has caused the state's unemployment compensation payments to remain at higher than desired or anticipated levels. This has put considerable pressure on the state budget by siphoning funds away from other vitally needed programs. Unfortunately, West Virginia has not been a part of the economic growth experienced throughout the United States over the past several years; consequently, there appears to be little chance of a significant reduction in the state's unemployment level in the near future.

Labor costs are also extremely important when analyzing business climates [1,7]. West Virginia's workforce is often thought to have a high level of unionization accompanied by relatively high manufacturing wages. This is a reflection of the predominance of the coal, chemical, and primary metal industries, all of which are highly unionized and have relatively high wages. Not all industries in the state, however, exhibit these characteristics. In a recent survey of West Virginia's wood products industry, conducted especially for this study, it was learned that the wood industry was not characterized by the high percentage of union membership and corresponding high wages found in other manufacturing and extraction-based industries. In fact, West Virginia's wood products industry posted a union membership of only 15.3 percent as compared to the 38.3 percent found in the state's manufacturing sector as a whole (Figure 2). Union membership in primary wood-using industries (logging, sawmilling, rustic fence, and charcoal manufacturing) was even less at 4.9 percent.

The high wages usually associated with union employees are not found in West Virginia's wood products industry. Wood industry wages are not only significantly lower than those in most other manufacturing industries in West Virginia, but these workers also have lower than average wage rates per production hour than do wood industry workers in neighboring states (Table 2) [8]. The total labor cost per man-hour worked in the sawmill industry was also found to be lower in West Virginia that in Pennsylvania and Kentucky [3].

Figure 2. Percentage of employee unionization in West Virginia's wood products industry, 1986.



Furthermore, only one work stoppage was documented in West Virginia's wood industry during the past two years—an indication of the industry's labor stability. In short, broad measures of the state's workforce can give a generally negative impression of labor in West Virginia, but a more detailed analysis of West Virginia's wood products labor force reveals that workers in the industry are definitely competitive with their counterparts in other states.

The Education System

The educational level and trainability of workers is critically important to the quality of any state's labor force. It has been noted repeatedly by the business community "that the economy is being increasingly built on knowledge" [7].

Table 2

Average wage rate per production hour in the wood products industry in West Virginia and neighboring states, 1982.

	Average wage rate per production hour[a]			Percent above or below region average		
State	(SIC 2400)	(SIC 2500)	(SIC 2600)	(SIC 2400)	(SIC 2500)	(SIC 2600)
Kentucky	6.08	6.09	9.12	-1.6	- 6.3	- 0.5
Maryland	6.41	5.68	8.25	+3.9	-12.6	-10.0
Ohio	6.46	7.72	9.36	+4.7	+18.8	+ 2.1
Pennsylvania	6.56	7.35	9.25	+6.3	+13.0	+ 0.9
Virginia	5.76	5.35	10.03	-6.6	-17.7	+ 9.4
West Virginia	5.57	5.93	8.06	-9.7	- 8.8	-12.1
Region Average[b]	6.17	6.50	9.17			

[a] Wages expressed in dollars per hour

[b] Average based on Total Prod. Wages in Region/Total # Prod. Hours in Region

Note: SIC 2400 — lumber and wood products
SIC 2500 — furniture and fixtures
SIC 2600 — paper and allied products

Source: [8]

According to the U.S. Bureau of Labor Statistics, by 1995 nearly 46 percent of all new jobs will require higher levels of education (post-high school), compared to only 38 percent today. Unfortunately, education is another area where West Virginia has serious deficiencies.

This is evident in the generally low level of education among West Virginia's population. Only 56 percent of West Virginia's adults, ages 25 to 64, have completed high school compared to the national average of 66.5 percent [13]. West Virginia also has the worst college completion rate in the U.S. with only 10.4 percent of its population completing four years of college as of 1980 [13].

Despite these statistics and the repeated advice of business leaders that "an investment in education is one of the best (investments) you can make" [7], the state continues to underfund its public education system at all levels. Public education expenditures per pupil in elementary and secondary schools in West Virginia in 1985 amounted to $2,866—compared to a U.S. average of $3,414 [13]. The point can be made that businesses pay for this deficit four times when faced with an undereducated workforce: (1) by experiencing lower productivity from underskilled workers, (2) by having to absorb the cost of training workers in the skills needed for the job, (3) by having to pay more to obtain qualified workers from somewhere else, and (4) by being taxed to support a public education system despite its inadequacy.

The quality of public education is of prime concern to businesses when considering the location of major capital investments.

Capital Availability

Difficulty in obtaining financial resources to support entrepreneurial activity has been mentioned as a major obstacle confronting the start-up of new enterprises in West Virginia [2,6]. Although there are a multitude of reasons why banks do or do not lend money, the fact remains that West Virginia banks rank last in the U.S. in the percent of all bank assets comprised of loans—only 48 percent in West Virginia, compared to the U.S. median of 57.5 percent and the national high of 81.3 percent in Delaware [7].

Without sufficient supplies of capital for both short and long-term capital investment borrowing, new business formation, business expansion, and job creation are stunted. Yet, *it appears* that one of the most vital links in the state's economic development program, the state banking system, is reluctant to invest in West Virginia. In 1985, West Virginia had the lowest per capita amount of outstanding commercial and industrial loans in the nation—$311 per person, while the national median was $947. Delaware had the highest level at $6,866 and Virginia had $1,007 in outstanding commercial and industrial loans per capita [7].

To boost business investments at home, numerous states have created programs to make money more available to would-be entrepreneurs. Apparently these state-funding capital investment pools work well when properly administered. Five of the top ten ranked states in *Inc.* Magazine's 1985 survey of business climates, including the top four, all offer a package of four state-backed financing programs including (1) direct loans, (2) loan guarantees, (3) bond guarantees, and (4) venture capital funds.

The scarcity of capital in West Virginia prompted the state legislature in 1985 to enact an economic development program which features two types of government-backed financing, direct loans and loan guarantees. The state now offers a wide range of financing programs all designed to stimulate new business initiatives. Some of the more important programs are summarized in Appendix Table A.

It is of major importance that the financial resources allocated to these programs be used in the most economically beneficial manner. Priority should be given to those projects which will stimulate additional secondary economic activity and offer long-term benefits. Proper planning via a knowledgeable committee would help ensure that scarce capital resources are not squandered on less worthwhile projects and that maximum returns are obtained from the use of these public funds.

In addition to programs already implemented in West Virginia, the state legislature passed, in its 1986 session, a bill allowing interstate banking in West Virginia. It is anticipated that this change will help provide the financial resources required to encourage business growth and expansion in the state.

Business Taxes

Generally, state taxes have been deemed to be relatively less important to the attractiveness of a state's business climate than those factors discussed previously. However, state taxes may be of somewhat greater concern to established and prospective businesses in West Virginia since the state relies primarily on a Business and Occupation tax—a tax based on gross business receipts rather than net income or profits. As originally enacted, the B&O tax was a counterproductive form of taxation when applied to new businesses or to expanding or marginal operations. State business leaders called its dampening effect on entrepreneurship "literally immeasurable" [10]. In response to these criticisms the state legislature revised the state's business tax system by passing the State Tax Reform on Business Act of 1985 (HB 1693) [12].

Beginning July 1, 1987, the Business and Occupation Tax will be replaced by a corporate net income tax, a franchise tax on manufacturing, and a severance tax on the production of natural resources. The Severance Tax rate on timber production will remain the same as the current B&O Tax rate (2.5 percent).

The Business Franchise Tax, which replaces the B&O Tax on manufacturing, will assess a levy based on the net worth of the corporation or partnership as determined for federal tax purposes. The rate of tax is .55 percent. Businesses that pay the severance tax also pay the business franchise tax, but timber producers will receive credit for that portion of their business franchise tax liability that is attributable to the business of timber production.

Other state taxes applicable to businesses in West Virginia include the corporate net income tax (rate of 9 percent effective July 1, 1987), the telecommunications tax, the business registration tax, the corporation charter tax, unemployment compensation tax, the worker's compensation fund, the secretary of state's fee, and in some cases, the sales tax and user tax. A city B&O tax is also levied in most municipalities.

Although the State Tax Reform on Businesses Act of 1985 did not immediately dispose of the B&O Tax, it did provide for a phaseout period to provide greater stability, certainty, and predictability during the transition period. Some provisions of the bill became effective July 1, 1985, but many of the changes will not be completed until July 1, 1987.

The B&O Tax, as it is now applied to the state's timber industry, provides for special treatment of timber production. The current tax law distinguishes timber harvesting activity (which is taxed at 2.5 percent) from manufacturing activity (which is taxed at .80 percent). In addition, enterprises which manufacture timber products may reduce their gross receipts by the cost of their timber raw material. This results in only the value added being subject to the B&O taxes under the manufacturing classification and eliminates the negative features of a gross receipts tax.

Timber production, as previously mentioned, is taxed independently of any further manufacturing. The B&O tax rate on harvesting is 2.5 percent of the gross value of the timber once it has been severed and delimbed [4]. One problem with this approach, however, is determining the value of the tree once it has been felled and delimbed. Most loggers do not have access to this cost/value information and can only estimate the value by using a percentage of the final sale price. The formula for doing this, again, depends on the type of business. There are three separate categories when considering the timber production classification under the 1985 B&O Tax: (1) the case of a logging contractor who does not buy stumpage, (2) the case of a logger who buys timber stumpage and resells it to a sawmill or other manufacturer, and (3) the case of a integrated manufacturer who buys stumpage and operates a logging crew. The B&O Tax is applied in each case as follows:

1. logging contractor—is taxed under a service classification at the rate of 1.15 percent or $1.15/$100 of gross revenues.
2. independent logger—is taxed under both the production and manufacturing classifications with gross revenues divided evenly between the two operations, i.e. 50% at 2.5% and 50% at .80%.
3. integerated manufacturer—is also taxed under both classifications but at different percentages compared to case 2. In this case the gross revenues from lumber sales are divided, with 25% being taxed under the production rate of 2.5% and 75% of the gross revenues taxed at .80%.

If nothing else, West Virginia's business tax structure is extremely complicated and has frustrated businessmen both in and outside the state. The phasing out of the B&O Tax and its 26 tax classifications will partially alleviate this situation but the calculation of business tax liability in West Virginia will continue to be a complicated task.

SPECIAL NOTE ON THE TIMBER SEVERANCE TAX

The severance tax in West Virginia is not a severance tax in the true sense. Usually, a severance tax is based on the volume of production. On timber it is usually assessed by the cord or per thousand board feet. However, West Virginia's severance tax will be assessed against a business' gross revenues, as under the current B&O Tax. By continuing to use gross revenues as the base on which the tax is assessed, the tax will remain a counterproductive force in an industry which is generally characterized by a high degree of competitiveness and already suffers from relatively high operating costs due to the nature of the terrain. Because none of West Virginia's five neighboring states imposes any form of a severance or yield tax on timber, it is possible that West Virginia timber may suffer some competitive disadvantage in the marketplace (Table 3).

Another shortcoming of West Virginia's timber severance tax legislation is that all tax receipts are deposited into the state's general revenue fund without any provision being made for contributing for forestry-related programs. Currently, local communities and governments, which experience the social and economic costs associated with timber production, receive no direct compensation for removal of the resource. Likewise, the state's Forestry Division and associated cooperative forestry programs receive no direct support from the so-called severance tax on timber. In many other states, revenues from taxes on timber removals and wood products are at least partly

Table 3
Severance/Yield tax rates in West Virginia
and neighboring states, 1985.

State	Severance Tax	Tax Rate	Comments
Pennsylvania	No	——	
Ohio	No	——	
Virginia	No	——	Forest Products Tax on Mfg.
Maryland	No	——	
Kentucky	No	——	
West Virginia	Yes	2.5%	Credit of B&O Tax

Note: Virginia does assess a forest products tax on manufacturing based on volume of production, but all tax revenues are earmarked for the state's forestry programs.

earmarked for state forestry programs. Similar treatment of West Virginia's severance tax receipts would greatly enlarge the state's forestry fund and provide potential financing for making loans or grants to timber-producing communities for supporting infrastructure improvements, business initiatives, job training, etc. Timber producers might also feel some consolation knowing their tax money was being reinvested in the state's timber resource.

THE PROBLEM OF WEST VIRGINIA'S BUSINESS IMAGE

In recent years West Virginia's image as a place to do business has suffered because the state has received poor ratings in highly publicized "studies" of states' business climates. Two reports which attempt to measure and compare manufacturing and small business climates of the individual states are cases in point.

In the 1985 Alexander Grant & Company annual study of manufacturing business climates, 22 economic factors were selected by state manufacturing associations as having the most profound effect on a state's business environment. These factors were then weighted according to their relative importance. Each state was then scored and ranked by individual factor and cumulative total (Table 4). In this study, West Virginia was ranked 45th out of 48 states, with a national score of 23.2 out of a possible 100.

In contrast to the Alexander Grant & Company study, *Inc.* Magazine's "Report to the States" was more concerned with the overall level of small business activity in the states and the level of support received from state governments, rather than with individual economic criteria. Factors in the *Inc.* study and their respective point values are listed in Table 5. As a group, capital availability and state support activities were judged to be the most important measures of a good business environment. According to their criteria, *Inc.* rated West Virginia as having the worst small business climate among the fifty states.

These reports and others like them are problematical in that they are not necessarily objective, consistent, or accurate in the evaluation of a particular state's business environment. The weighting of economic factors in the Alexander Grant & Company survey, for instance, changes (sometimes drastically) from year to year, so that a particular state's ranking may change appreciably for that reason alone [16]. Similarly, the "factors" in *Inc.*'s ranking scheme are supposed to measure the climate for small businesses, yet some are so broad that subtle but important elements in a state's small business environment may be completely masked or overlooked in the ranking process.

Whatever the degree of scientific validity of these and similar studies, two vital points must be borne in mind: (1) both of the cited studies rate West Virginia's business climate as among the poorest in the United States, and (2) these and similar reports influence the perception of West Virginia held by

Table 4

Economic factors included in the 1985 Alexander Grant & Company's annual study of manufacturing business climates, showing West Virginia's national and regional ranking.

Factor	1984 Factor Weight	1984 National Rank	1984 Regional** Rank	Contributions to State's Score
1. Lowest energy costs	7.78%	9	1	Positive
2. Lowest wages	7.05	39	6	Negative
3. Lowest unionization rate	6.56	41	4	Negative
4. Least manhours lost	5.58	1=	1	Positive
5. Lowest WCI rates*	5.55	16	1	Positive
6. Lowest taxes*	5.06	34	5	Negative
7. Highest value added	5.04	38	5	Negative
8. Expenditure vs. revenue growth*	4.76	10	1	Positive
9. Favorable change in wages*	4.70	16	4	Positive
10. Lowest UC benefits*	4.38	48	6	Negative
11. Highest UC net worth*	4.37	46	5	Negative
12. Favorable change in taxes*	4.21	37	6	Negative
13. High School educated adults*	4.14	47	6	Negative
14. Lowest maximum WCI payment*	4.04	39	5	Negative
15. Fewest environmental controls*	3.94	48	6	Negative
16. Highest Voc-Ed enrollment*	3.87	9	1	Positive
17. Favorable change in unionization	3.84	45	6	Negative
18. Lowest debt*	3.71	20	1	Positive
19. Most hours worked	3.24	35=	4	Negative
20. Lowest welfare expenditure*	2.93	10	1	Positive
21. Greatest population growth	2.71	40	5	Negative
22. Highest population density	2.54	24	6	Negative
	100.00%			

*Indicates factor is controlled or strongly influenced by state or local government.

**Region includes New Jersey, Maryland, Delaware, New York, Pennsylvania, and West Virginia.

WCI — Workman's Compensation Insurance; UC — Unemployment Compensation.

= Denotes tie in rank.

Source: Adapted from [1].

Table 5
Business factors measured in the *Inc.* Magazine
"Report on the States," 1985.

Factor	Point Value
Capital Availability	25
State Support for Business	25
Labor Costs and Availability	20
Business Activity	20
Business Taxes	10

Source: [7].

many business leaders and entrepreneurs throughout the rest of the nation. Rightly or wrongly, surveys, studies, and reports such as these have damaged West Virginia's reputation as a place to do business. If West Virginia is to improve its image relative to the rest of the nation, it must dispel any unsubstantiated or inaccurate assessments of its business climate; further, it must work seriously and persistently to improve in areas where poor ratings are valid.

DISCUSSION

Naturally, the state's wood-based industry is influenced by and subject to the overall economic climate indigenous to West Virginia. The political atmosphere, the condition of the physical infrastructure (roads, utilities, etc.), the education system, capital availability, and labor force characteristics affect all industries operating in the state. But the wood products industry is—like each other industry—unique and has some business characteristics and requirements which do not conform to any general assessment of the state's business climate.

In forest-based industries timber resources are a unique as well as an important consideration. Primary wood industries are highly dependent on the availability and quality of the timber resource. West Virginia does have some advantage in this respect, though not quite as much as some would think. While it is true that West Virginia has a great volume of select red and white oaks and large quantities of other fine hardwoods [20], much of the projected increase in demand for hardwoods is based on increasing utilization of lower quality raw material, i.e., pulpwood, chips for reconstituted products, and fuelwood [21]. These lower quality hardwood trees are also available in large quantities in most competing states. West Virginia's advantageous timber resource position, therefore, is somewhat qualified by the nature of expected future wood product raw material requirements.

A wood products company considering expansion or location of a new facility must make two major assessments: Is the natural resource adequate? Is the business climate favorable? Given that West Virginia does not have an overwhelming resource advantage, the status of the state's business climate is of critical importance. Any advantage which exists in West Virginia's timber resource, then, could be negated by a poor business environment.

The basic problems with West Virginia's physical infrastructure cannot be remedied overnight. Persistent underfunding of the state's educational system has a major negative effect on West Virginia's ability to attract business. Capital resources are still scarce in West Virginia, and although the state-sponsored capital funding programs are a step in the right direction, the level of financial support available from the state's economic development office is not yet enough to encourage substantial investments by the private sector.

The business climate for forest-based industries in West Virginia is somewhat better than the state's business climate as a whole, but the magnitude of the deficiencies evident in its supporting infrastructure and business laws still dampen forest-based investments in West Virginia. This conclusion is supported by the fact that major capital investments in forest-based industries suitable for location in West Virginia are already being lost to neighboring states. One reason why these facilities are not being located in West Virginia may be the reputed poor competitiveness of the state's business environment. This undisputed and widely held misconception of West Virginia as being a uniformly poor location to do business is making it all the more difficult for the state to improve itself.

Currently, state government is undertaking a number of actions to modernize and rationalize various things which affect the business environment. The statewide property tax reappraisal is being implemented. It will gradually increase funding for local governments and public education. The State Legislature's passage in 1985 of a wide-ranging economic development act established or authorized several initiatives in economic development for the state [11]. Revisions of the B&O tax system and the state's new business capital financing program have already been mentioned. It will take time for these economic development initiatives to affect the business climate and level of economic activity in the state. Accordingly, the state's governmental and business leaders should not, if instant results do not occur, be impatient and abandon new policies and programs before they have an opportunity to be effective.

Finally, West Virginia must adopt a strategic plan designed to guide the state through the challenging process of upgrading its infrastructural components and coordinating the redevelopment of its economic base. Although West Virginia's three major industries—coal, chemicals, and primary metals—are still very capable of providing future economic growth, these industries are highly cyclical. State planners, therefore, must seek out and develop those industries which have the greatest potential to diversify, accelerate, and sustain economic growth and which are capable of being competitive in both the national and world economies. The forest products industry in West Virginia has such potential, and with planning and some assistance, is capable of providing additional jobs, income, and other economic benefits in the not too distant future.

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APPENDIX TABLE A

A summary of selected Financial Incentive Programs in West Virginia applicable to forest-based investments.

The State of West Virginia offers a variety of financial incentive programs through the Office of Community and Industrial Development to promote the state and to attract business and industry. These programs are designed to assist those enterprises which create or retain jobs. The primary purpose of these incentive programs is to "buy down" the cost of doing business in West Virginia through low-interest loans or other financial arrangements such as a purchase/leaseback on building facilities. West Virginia's financial incentive programs for business include:

(1) *West Virginia Economic Development Authority*—WVEDA provides low-interest loans from a revolving fund for land acquisition, building construction and equipment purchases. There are no specific eligibility requirements; however, the loan programs are geared toward manufacturing firms with an emphasis on new job creation.

WVEDA may participate in up to 50% of a project's cost with a general lending guideline limit of $500,000 per project. The terms range from 10 to 20 years and interest rates are set on a case by case basis depending upon the economic impact of the project and the source of funds utilized for the loans. Normal collateral position is a shared first lien position with other lenders.

(2) *State Industrial Development Pool Funds*—WVEDA may offer direct loans to larger industrial development projects by using a $50 million investment fund set aside by the state Board of Investments. The loan structure and application process are similar to the WVEDA revolving loan funds but letters of credits are required for security. Rates are based upon thirteen-week Treasury Bill auction rates.

(3) *Tax-Exempt Industrial Revenue Bonds*—Low-interest Industrial Revenue Bonds are available under IRS regulations and may be issued through WVEDA or through counties and municipalities. These bonds are exempt from income tax at the federal and state level and are available to a wide variety of projects with the potential of reducing fees and interest rates.

(4) *West Virginia Certified Development Corporation* (SBA 503)—This program provides long-term fixed rate loans for small and medium-sized firms. Interest rates are tied to Treasury Bond rates of comparable maturity. The maximum amount for which a loan can be made under this program is $500,000.

(5) *Business and Industry Guaranteed Loan Program* (Farmers Home Administration)—This is an assurance to protect the investor and may cover up to 90% of the principal advanced including protective advances and accrued interest.

(6) *Treasurer's Economic Development Deposit Incentive Program* (TEDDI)—This program provides low-cost financing for businesses that operate exclusively in West Virginia with employment of less than 200 or with gross receipts of less than $4 million that will use the financing to create jobs.

Eligible businesses make a normal loan application to a commercial lender. Upon approval of the loan by the lender, the State Treasurer's Office places a certificate of deposit at the participating institution at 3 percent below prevailing market rates to allow the lender to pass through a comparable below market rate to the business. The State Treasurer has authority to use up to $100 million for purchasing certificates of deposit from commercial lenders up to 3 percent below current certificate of deposit rates to provide funds for the TEDDI Program.

(7) *West Virginia Industrial and Trade Jobs Development Corporation*—This organization has been established to supplement other financial incentive programs to help create jobs. Loans can be made to the corporation from the Board of Investments up to $10 million per project at negotiable interest rates and terms. This program is not restricted to a specific job creation level and this organization has the flexibility to fund many types of projects.

(8) *Conventional Financing Sources*—The Governor's Office of Community and Industrial Development maintains contacts with several area and regional banks.

For further information on financial incentive programs contact:

Patrick C. Graney III
Financial Strategist
M-146
State Capitol
Charleston, WV 25305
(304) 348-0400

Definition of Terms

Capital—wealth in the form of money or property which can be owned, used, accumulated, or borrowed by a business or individual, and is available for use in the establishment, operation, or expansion of a business.

Industrial Infrastructure—the basic facilities, equipment, and installations needed for the functioning of an industrial system, generally including the following: (1) an adequate transportation system, (2) an adequate supply of skilled labor, (3) available commercial and industrial sites, (4) a sufficient water supply, (5) a satisfactory education system, and (6) available cultural and recreational opportunities.

Loan Guarantees—commercial loans granted by a private financial institution and guaranteed by a third party, usually some public entity such as a state or federal government, the purpose of which is to provide the borrower with access to capital usually at a lower interest rate by transferring the assumption of risk to the guarantor.

Severance Tax—a tax typically administered by a state government and levied at a set amount per unit of production, i.e., per ton of coal or thousand board feet of timber; a true severance tax has no tie to the value of the product produced but many states have modified the tax by applying different rates to various qualities of the product.

Venture Capital—capital available for investment in a business initiative that involves an inherent risk or is of doubtful outcome; usually associated with "seed" money for a new business enterprise.

FORESTS & THE WEST VIRGINIA ECONOMY

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Forests and the West Virginia Economy

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Volume 2: The Timber Resource

Volume 3: The Commercial Timber Harvest in West Virginia

Volume 4: The Size and Economic Performance of West Virginia's Wood Products Industry

Volume 5: The Economic Importance of Forest-based Industries in West Virginia

Volume 6: Growth Potential and Development Prospects for West Virginia's Timber-based Industries

Volume 7: The Business Climate for Forest-based Industries in West Virginia

AGRICULTURAL RESEARCH FOR A BETTER TOMORROW

Hatch Act Centennial
1887-1987

Authors

Gary Zinn is forest scientist and Kenneth D. Jones is research assistant in the Division of Forestry, West Virginia Agricultural and Forestry Experiment Station, West Virginia University.

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West Virginia University
Agricultural and Forestry Experiment Station
College of Agriculture and Forestry
Robert H. Maxwell, Director
Morgantown

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FOREWORD

This is the eighth and final volume in a series of reports on West Virginia's forest resources. The *Forests and the West Virginia Economy* Series focuses mainly on the timber resource and the timber-based economy. Although observations on other forest resources are included, these are not examined in detail.

The series has examined the state's forest resources, their current levels of utilization, their present role in the state's economy, the outlook for the future, and the prospects for increasing the economic contribution of forests and forest-based activity in West Virginia.

This volume summarizes findings from the seven previous bulletins and presents the conclusions reached during this examination and evaluation of West Virginia's timber-based economy. The authors present recommendations for improving the size, structure, and economic performance of the state's wood products industry and for increasing the economic contributions from timber-based activity in West Virginia.

The research reported here was conducted under the auspices of the West Virginia Agricultural and Forestry Experiment Station at West Virginia University. Major financial support was provided by the West Virginia Governor's Office of Community and Industrial Development and by the Experiment Station. Other principal cooperators include the West Virginia Department of Agriculture (Division of Forestry), the USDA Forest Service, and the West Virginia Forestry Association.

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FORESTS AND THE WEST VIRGINIA ECONOMY

8: Summary of Findings, Conclusions and Recommendations

Gary W. Zinn and Kenneth D. Jones

INTRODUCTION

The "Forests and the West Virginia Economy" project had several objectives. First, to provide an up-to-date picture of the contributions of forests and timber-based activity to West Virginia's economy. Second, to assess probable future demands on the state's forests and their potential to meet those demands. Third, to identify any basic obstacles to development of forest-based activity in the state. And finally, to give political and business leaders and citizens of West Virginia a better basis for forming attitudes and making decisions that involve forest resources management and forest-based economic activity.

The specific findings and some major conclusions reached in the study have been reported in previous volumes of this series. This final report contains a summary of findings, a discussion of overall conclusions, and a listing of recommendations. The recommendations concern policies and programs which have potential to promote growth in the state's timber-based economy, improve its performance, and enhance its contribution to West Virginia's overall economy.

SUMMARY OF FINDINGS

Volume 1: *Forest Land Base; Forest History and Types; Forest Ownership and Inventory*

West Virginia's forests, which cover over 80 percent of the state, have recovered from past exploitation to potentially become a major source of *hardwood*[1] timber in the United States. The state's 11,484,000 acres of *commercial forest land* grow over 820 million *board feet* of new *sawtimber volume* each year. This is more than twice the annual harvest for use as lumber or other wood products. Second growth forest is the predominant land type in the state.

The state's forests can be divided into three major categories: the oak-pine forests of the Eastern Panhandle, the mountain forests found in the higher elevations of the Allegheny Mountains, and the mixed central hardwood forests, which cover much of the remainder of the state. The hardwood forests are extremely diverse, with over 50 commercial species occurring over a wide range of site and productivity classes. Species of major economic importance include red oak, white oak, yellow poplar, sugar maple, hickory, black cherry, and black walnut. The state offers good tree growth conditions with possible sawtimber rotations of 50–100 years.

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[1] Technical terms which may be unfamiliar to the reader are printed in italics at their first use and are defined in the appendix.

In 1974–75 there were approximately 15.8 billion *cubic feet* of timber in West Virginia's commercial forests. Of this total about 8.05 billion cubic feet, or 52 percent was *sawtimber tree* size. Of the state's 27.63 billion board feet of sawtimber volume, over 90 percent was in hardwoods and less than 10 percent was in *softwoods*, exemplifying the state's potential as a major source of hardwood lumber. At current harvest levels it would take approximately 90 years to remove the existing sawtimber volume alone (excluding net annual growth).

In 1975, the USDA Forest Service estimated that there were 207,500 owners of private commercial forest land in West Virginia. Private, non-corporate owners comprise 88 percent of all commercial forest landowners in the state. Thirty percent of the private commercial forest land is owned by fewer than 500 owners or less than 0.2 percent of all owners. Individuals own 63 percent of the land, while corporations own approximately 29 percent of the commercial forest land. Various public holdings amount to about 8 percent of all commercial forests in West Virginia.

Various estimates indicate that forest industries contribute significantly to the state's economy:

- In 1982, timber-based industries shipped $381.8 million worth of products. *Value added* through manufacture totalled $160.4 million. The state's wood-based industry consisted of approximately 436 firms employing 6,400 workers with a payroll of $76.6 million.[2]
- The state's recreation industry, which includes travel, tourism, skiing, whitewater rafting, camping, hunting and fishing, and many other outdoor activities, employs about 40,000 people and contributes at least $1.5 billion a year to the state's economy.
- The travel and tourism industry employs 29,700 people in West Virginia and is estimated to generate economic activity of $1.1 billion dollars a year; this figure ranks 38th in tourism dollars among the 50 states.
- The West Virginia park system contributes an estimated $49 million annually to the state's economy.

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[2] Information on the timber industry presented in Volume 1 was superseded by 1982 data first presented in Volume 4. The statistics appearing here are from the 1982 Census of Manufactures Survey which does not appear in Volume 1.

- It is estimated that the whitewater rafting industry contributes $30–$50 million annually to the state's economy.
- The DNR reports that $309 million is spent on wildlife related activities each year.

The forests of West Virginia support these activities with little effort and negligible strain on the resource. In fact, the forests are growing in both volume and acreage every year. The potential uses and revenue-generating opportunities of this unique resource have barely been tapped, and more attention should be directed toward the forests as a means of strengthening and expanding the state's economy.

Volume 2: *The Timber Resource*

Although West Virginia ranks only 41st among the states in total land area, it ranks 25th in total commercial forest land and 17th in total acreage in sawtimber-sized trees. West Virginia also has 2 percent of all U.S. timber *growing stock volume*, 20th highest of all the states. In hardwood growing stock volume, West Virginia is 5th in the nation with 5.1 percent of the U.S. total. In terms of hardwood sawtimber volume, it ranks 8th in the nation with more than 26 billion board feet of hardwood sawtimber standing in its forests. This represents 29.9 percent of the northeast's[3] hardwood sawtimber volume, placing it second behind the region's leader, Pennsylvania.

West Virginia's forest lands are highly productive, with 4.76 million acres of commercial forest land capable of growing 85 cubic feet or more of wood per acre per year; this is 6 percent of all forest land in the nation capable of this high a growth rate. Altogether, 83 percent of the state's commercial forest land is capable of growing more than 50 cubic feet of wood per acre per year. This means that the bulk of West Virginia's forests are capable of producing profitable crops of timber on a sustained basis.

The forest survey of 1974–75 found 15.8 billion cubic feet of timber in West Virginia's forests, of which 87 percent, or 13.5 billion cubic feet, represented West Virginia's growing stock. Statewide growing stock volume per acre averaged 1,177 cubic feet, while sawtimber volumes averaged 2,406 board feet per acre. Oaks accounted for 43 percent of all sawtimber volume. In 1975, 82 percent of the commercial forest land in West Virginia was either fully stocked or overstocked with live trees.

In 1975, 7.8 billion board feet or 31 percent of the sawlog volume was contained in high quality logs and classified in *log grades* 1 and 2. This is important to the state's sawmilling industry, since the state's main wood product is high quality lumber from high quality logs.

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[3] Includes Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, Delaware, Maryland, New Jersey, New York, Pennsylvania, and West Virginia.

Forty-six percent of the net sawtimber volume was found in grade 3 logs. The high percentage of low grade logs is directly related to the large volumes of 12- to 14-inch *dbh* trees, which by current definition are too small to be included in higher log grades. As the forests age, these trees will increase in diameter and many will improve in quality.

The attitudes and intentions of forest land owners regarding timber harvesting are also important determinants of the effective timber supply. Over 90 percent of West Virginia's commercial forest land is in private ownerships. Private landowners who may be expected to manage and harvest their timber controlled about 8.7 billion cubic feet of growing stock and 17.6 billion board feet of sawtimber in 1975,—64 percent of the state's total inventory of both. The inventory and growth rates on these lands greatly exceed present *timber removals*, indicating that the state's forests could readily sustain a timber harvest and dependent wood-using industry of at least twice the present size.

Projections based on the 1975 inventory estimate that in 1985, West Virginia had a standing sawtimber inventory of 30.7 billion board feet and a total growing stock inventory of 16.9 billion cubic feet; increases of 11.5 percent and 25.1 percent, respectively, since 1975. By 2005, hardwood growing stook is expected to increase by 85 percent and softwood growing stock by 210 percent over 1975 volumes. Average growing stock volume per acre is expected to nearly double during the 1975–2005 period.

At the national level, demands on domestic hardwood forests are expected to increase by over 100 percent by the year 2000 to 6 billion cubic feet. Hardwood supplies should be adequate until the turn of the century, with increasing shortages thereafter. In view of these demand-supply relationships, there appear to be substantial opportunities to increase the size and diversity of the timber-based economy in West Virginia.

Volume 3: *The Commercial Timber Harvest in West Virginia*

In 1979, West Virginia's timber producers harvested 89.3 million cubic feet of *roundwood* from the state's forests. About 92 percent (81.8 million feet) of the harvested timber was hardwoods and 8 percent (7.4 million feet) was softwoods. Most of the timber harvested came from the northeastern and southern geographic units of the state. These two units accounted for 85 percent of the state's total harvest, 85 percent of all *sawlog* production, and 90 percent of the state's *pulpwood* harvest in 1979. Seventy-three percent of the state's total harvest was processed as sawlogs and manufactured into lumber. Approximately 10.72 million cubic feet of roundwood, or 12 percent of the state's *timber harvest*, was cut for pulpwood and exported to paper mills in neighboring states; 11.69 million cubic feet, or 13 percent of the roundwood harvest went into the production of mine timbers and fencing. The remaining portion of the harvest was used in the veneer and cooperage industries or was manufactured into cabin logs, dimension bolts, handle stock, wedges, and other miscellaneous wood products.

From 1974 to 1979, the total industrial roundwood harvest in West Virginia fell 17.5 million cubic feet, a 16 percent drop in the state's total timber output. The timber harvest in West Virginia decreased 32 percent between 1965 and 1979, despite a 16 percent increase in the state's timber supplies. These declines were primarily the result of lower sawlog harvests—down 9.8 percent from 1974 and down 23 percent from 1965. Pulpwood harvests had dropped 60 percent from 1965 to 1979 but increased 150 percent in 1980 and rose to an all-time high in 1982 (457 thousand *cords*). West Virginia has no pulpmills and all pulpwood production is exported. West Virginia is the leading pulpwood exporter in the northeast.

More timber was cut in 1979 than in 1974 for only three minor products—veneer logs, mine timbers, and fencing. There was a 300 percent increase in veneer log harvests, a 13 percent increase in cutting of mine timbers, and a 42 percent increase in production of fence material.

In 1979, West Virginia woodland owners received $39.7 million from the sale of *timber stumpage*. Compared with other agricultural crops, the timber harvest ranked as the state's third largest cash crop in 1979, surpassed only by dairy product sales ($40.5 million), and the beef cattle industry ($68.2 million).

The largest and most valuable component of the 1979 timber harvest was sawtimber. Sawmills and other buyers of sawtimber stumpage paid about $31 million to forest landowners, accounting for about 78 percent of the total estimated stumpage value of the 1979 timber harvest. The sale of timber for veneer logs brought woodland owners revenue of almost $4.7 million, while mine timber stumpage worth just under $2 million was sold. The 1979 Christmas tree harvest was worth $1.07 million. Other timber products, including pulpwood, fencing, cooperage, and miscellaneous, represented less than $1 million each in stumpage value.

Volume 4: *The Size and Economic Performance of West Virginia's Wood Products Industry*

Data from the 1982 Census of Manufactures show that West Virginia's wood industry shipped $381.8 million worth of products and added $160.4 million in value through manufacture; the state's wood-based industry consisted of 436 firms which employed 6,400 workers. The industry's annual payroll amounted to $76.6 million.[4]

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[4] These figures cover only economic enterprises which harvest timber and process it into wood products. Enterprises and individuals engaged in the management of forests for timber production and other purposes are not included. Neither are support activities such as trucking, provision of equipment, supplies, and utilities.

In 1982, the wood products industry represented about 26 percent of all manufacturing establishments in the state, 7 percent of all manufacturing employment, and 4 percent of all manufacturing payrolls. Ranked among all West Virginia manufacturing industries in 1982, the wood products industry was fifth in employment and seventh in annual payroll and value added. Overall, the wood products industry employed about 1.5 percent of the state's total labor force and accounted for roughly 1 percent of *all* payrolls statewide. In terms of size and economic performance, the wood industry is comparable to the state's oil and gas extraction industry.

West Virginia's forest-based industries often represent an important, if not dominant, local industry. Wood processing represents nearly all manufacturing in Webster County, is of notable importance in Braxton, Randolph, Preston, and Greenbrier counties, and is of modest significance in Kanawha, Mercer, Upshur, and Wayne counties.

The primary wood products industry, which includes those establishments actively engaged in the harvesting, transportation, sawing, slicing, chipping, or other initial processing of raw wood material, dominates the state's forest industry. The primary industry accounts for 77 percent of all wood product establishments, 57 percent of wood-based employment, 48 percent of the wood industry's value of shipments, and 47 percent of the industry's value added. Rough, green lumber is the state's major primary wood product.

Firms in West Virginia's secondary wood industry are engaged in the remanufacture of lumber, plywood, veneer, paper, and other primary wood products into finished goods. In 1982, the Census of Manufactures reported only 81 establishments in the state's secondary wood industry. They employed approximately 2,700 workers and had an annual payroll of $37.8 million. The secondary wood industry shipped $198.1 million worth of products and added $84.2 million in value through manufacture. Considering the availability of raw materials and the size of the state's primary wood industry, the secondary wood industry is not as diversified nor as extensive as it could be. The majority of the state's secondary wood-using firms are small, employ relatively few workers, and fail to reach potential markets. For example, only 54 percent of all secondary wood-using firms employ more than 20 people. In 1981, West Virginia ranked 25th among all states in volume of timber harvested but only 39th in value added through manufacture of wood products. This indicates that the full value of the state's timber resource, as well as potential employment opportunities and other economic benefits, are not being realized due to the present size and structure of the state's secondary wood products industry.

Most important among secondary wood manufacturers is the allied paper products industry, which accounted for 44 percent of secondary employment, 55 percent of secondary payrolls, and 56 percent of value added in secondary wood manufacturing.

Recent trends in West Virginia's wood products industry indicate a substantial decline in the state's timber-based economy since the early 1970's. This decline extended to practically every segment of the wood industry and resulted in the loss of 2,400 jobs and the closing of more than 100 wood-based establishments. By 1982, the value of shipments from the wood industry had fallen almost 17 percent, in constant 1982 dollars, over the previous ten years. This contributed to a nearly 30 percent drop in value added through the manufacture of wood products over the same time period. The severe recession experienced in the early 1980's accentuated this decline and depressed the wood industry to its lowest levels in more than 20 years. During this time, expenditures in constant dollars for new capital investments declined 43 percent.

Although these negative trends were found in the wood industry outside the state as well, the consequences of these conditions probably fell more heavily on West Virginia because of the small, unintegrated, and undiversified nature of its wood industry. It was these structural characteristics, combined with a poor economy, that forced many wood-using firms to reduce operations or shut down unprofitable mills. Because of these characteristics, and because of the scarcity of investment and operating capital, it is not likely that West Virginia's wood industry, on its own, will quickly reverse the trends observed from 1972 to 1982. Rejuvenation of the wood products industry will require purposeful, coordinated efforts by both public and private economic interests in the state.

Volume 5: *The Economic Importance of West Virginia's Wood Products Industry*

In 1982, the timber-based industry in West Virginia comprised only a small percentage of the total state economy—contributing less than 1 percent to West Virginia's *gross state product*. But the economic importance of the industry is greater than the volume and face value of its material and monetary outputs. The timber-based industry stimulates a considerable amount of related business activity and generates a significant amount of state revenue.

In 1982, $1 out of every $25 of manufacturing shipments, value added, and payrolls was directly attributable to the state's wood-based industries. That same year, West Virginia wood-based industries exported more than $111 million worth of wood products—approximately 1 percent of the value of all state exports. The majority of wood product exports were generated by sawmills and planing mills (45 percent), wood preserving establishments (20 percent), wood kitchen cabinet makers (12 percent), and firms producing wooden pallets and skids (8 percent). Combined, these four industry sectors accounted for 85 percent of the value of all wood products exported from West Virginia.

The state receives additional direct monetary benefit from forest-related activity through taxation and direct sales of publicly owned forest goods. In fiscal year 1982–83, public revenue directly attributable to forest-based activity amounted to approximately $26.2 million. This total included roughly $1 million from the direct sale of forest products, $19.8 million from the collection of forest-based recreation, wildlife, and water resource receipts, almost $1 million in direct payments from the U.S. Forest Service, and approximately $4.3 million in business tax receipts. Additional monies from forest property taxation, sales taxes, personal income taxes, and other varied sources were also directly attributable to the state's forest industries but these totals could not be readily and accurately determined. These additional monies, however, would significantly increase the $26 million figure.

All of the above are direct measures of the wood products industry's contributions to the state economy. An added dimension of economic contribution concerns the secondary effects which result from the wood industries' interactions with other sectors of the state's economy. When a sawmill buys logs, for instance, income flows to forest landowners, loggers and truckers; processing of the logs provides jobs and income to mill workers. Lumber sold by the mill to a secondary manufacturer within the state increases internal economic activity, and wood products exports bring additional income into the state.

"Multipliers" derived from an input-output model are used to estimate the secondary effects of a sector's activity on the regional economy of which it is a part. "Type I" multipliers measure the total effects of business transactions between the wood industries and other state businesses from which they buy supplies and to which they sell products (interindustry). "Type II" multipliers include the Type I effects plus the ultimate effects of wage and salary earners spending their incomes in the regional economy. This spending stimulates many sectors of the economy, particularly retail trade and services.

The latest input-output model for West Virginia is for 1982. This model has been analyzed to determine Type I and II multipliers for value added, income, and employment for the wood products industries (lumber and wood products, wood furniture and fixtures, and paper products) in relation to all manufacturing industries in the state. The results appear in the tabulation below. The numbers are interpreted as follows: For value added, the Type I multiplier for wood industries (1.68) indicates that for every dollar of value added generated by the wood industries, an additional 68 cents is generated by other industrial activity directly as a result of wood industry activity. The Type II multiplier (2.66) implies that every dollar of value added generated in wood industries ultimately generates another $1.66 in the state's economy as a whole. The multipliers for income are interpreted in exactly the same way. Employment multipliers are best interpreted in even units. The wood industries Type I employment multiplier (1.55) implies that every 100 jobs in wood industries leads directly to 55 added jobs in the state, while the Type II multiplier (2.38) means that 100 jobs in wood industries ultimately supports 138 additional jobs overall in the state.

	Type I	*Type II*
Value added multiplier		
Wood industries	1.68	2.66
All manufacturing	1.56	2.47
Income multipliers		
Wood industries	1.54	2.23
All manufacturing	1.47	2.14
Employment multipliers		
Wood industries	1.55	2.38
All manufacturing	1.59	2.57

These multipliers indicate that the wood products industries are an important driving force in the state's economy. For value added and employment, the wood industries multipliers are somewhat above the all manufacturing average and wood industries employment multipliers are only slightly below that average. This implies that establishment of new wood industries enterprises would generate positive impacts on the state economy as a whole.

Volume 6: *Growth Potential and Development Prospects for West Virginia's Timber-based Industries*

Although West Virginia cannot greatly influence the economic climate affecting its timber-based industries, future projections of domestic and worldwide demands for wood products create some very substantial opportunities for timber-based economic expansion in West Virginia.

Currently, the U.S. consumes more forest products (70 cubic feet per capita per year) than any country in the world—accounting for 25 percent of world consumption. The U.S. is also the world's leading industrial source of forest products—producing 35 percent of the world's paper, 45 percent of its plywood, and 20 percent of its softwood lumber.

Latest U.S. Forest Service assessments project significant increases in both domestic and world demand for timber products. Demands for hardwood roundwood from domestic forests are expected to rise to 7.6 billion cubic feet by 2000 and to 10.7 billion cubic feet by 2030—an increase of approximately 114 percent over 1980 levels. Future hardwood lumber consumption is expected to climb from 6.9 billion board feet in 1980 to 10.9 billion board feet by the year 2000 and to 16.0 billion board feet by 2030. This indicates a strong future demand for West Virginia's products.

The paper and allied products industry is also expected to continue its brisk and steady growth. New papermaking technologies have been developed to make primary paper products from all-hardwood virgin pulp. West Virginia can anticipate increased marketability of its hardwood roundwood and new development opportunities for both primary and secondary paper manufacturing.

Perhaps the greatest potential for large scale expansion of West Virginia's wood products industry is associated with structural composite panels and fiberboard, particularly with board panels such as oriented strandboard, waferboard, and medium density fiberboard. These industries have tremendous growth prospects with large increases in consumption and production expected within the very near future. West Virginia, with its tremendous supply of yellow-poplar and other medium density hardwoods, should be in an ideal position to benefit from the development of these new products.

The authors conclude that real growth in West Virginia's wood products industry lies in a coordinated effort aimed at producing higher valued secondary products from primary wood products, developing and implementing an effective marketing program for the state's wood products and aggressively pursuing wood product manufacturing facilities which are suitable for location in West Virginia.

Volume 7: *The Business Climate for Forest-based Industries in West Virginia*

Given the expected increases in future world-wide demand for wood products, the prospects for growth in West Virginia's wood products industry would seem to be quite promising. However, the state has had a reputation, be it imagined or real, of having a relatively unattractive climate in which to do business. This widely held misconception of West Virginia as being a uniformly poor location to do business is having a negative impact on the development of the state's forest-based industry.

Economists agree that there are certain necessities needed to support industrial activity. These are: an adequate transportation system; an adequate supply of labor with the necessary skills; readily available commercial and industrial support structures; a sufficient supply of acceptable process water; a satisfactory system of public education; and the availability of cultural and recreational amenities. Although some segments of West Virginia's industrial infrastructure are adequate to support a healthy economy, other sectors, such as the state transportation system, the public education system, and the state's labor force in general, have been subjected to some valid criticisms.

West Virginia's transportation system suffers from an underdeveloped interstate highway system and an underfunded state highway department with a backlog of needed road maintenance and repairs. Many bridges throughout the state are structurally deficient and/or functionally obsolete and posted with reduced weight limits which are extremely detrimental to an industry that must transport heavy materials The number, location, and condition of secondary roads and bridges, as well as the existence of interstate connections, is an extremely important part of the state's infrastructure. In its present condition the transportation system must be considered to have a major negative impact on business in the state.

The quality of the state's labor force is also of great importance to business. Unfortunately, West Virginia's labor force has been widely criticized for maintaining a high level of union membership, with relatively high wages. It has also been perceived as having a history of labor strife—exhibiting a higher than average percent of time lost due to work stoppages. The labor situation, however, differs greatly among individual industries. Caution must be used when interpreting broad measures of a state's labor situation.

In a recent survey of West Virginia's wood products industry, conducted especially for this study, it was learned that the wood industry was not characterized by the high percentage of union membership and corresponding high wages found in other manufacturing and extraction-based industries. West Virginia's wood products industry posted a union membership of only 15.3 percent as compared to the 38.3 percent rate found in the state's manufacturing sector as a whole. Union membership in primary wood-using industries was even less at 4.9 percent.

The high wages usually associated with union employees are not found in West Virginia's wood products industry. Wood industry wages are not only significantly lower than those in most other manufacturing industries in West Virginia, but workers in the state's wood industry also earn average wage rates per production hour which are lower than those of wood industry workers in neighboring states. Only one work stoppage was documented in West Virginia's wood industry during the past two years.

Although wages and labor stability are certainly important in assessing the quality of a state's labor force, the educational level and trainability of workers may be of greater importance. Unfortunately, West Virginians have one of the lowest average levels of education in the nation. Between 57 and 66 percent of West Virginia adults age 25–64 have completed high school. The state also has the worst college completion rate in the U.S., with only 10.4 percent of its population having completed four years of college as of 1980. Public education expenditures per pupil in elementary and secondary schools in 1985 amounted to only $2,866, compared to a U.S. average of $3,414. The negative long-range consequences that an underfunded education system has on West Virginia's economic development cannot be overemphasized.

Other factors also have an effect on how the state's business climate is perceived. For small businesses, capital availability is of prime importance. However, West Virginia banks rank last in the U.S. in the percent of all bank assets comprised of loans, only 48 percent compared to the national median of 57.5 percent and the national high of 81.3 percent in Delaware. In 1985, West Virginia also had the lowest per capita amount of outstanding commercial and industrial loans in the nation—$311 per person; the national median was $947. To make capital more available, the State of West Virginia enacted government-backed financing programs in 1984. These programs included direct loans, loan guarantees, and bond guarantees. In 1985, the state legislature enacted the State Tax Reform on Business Act. The major provision of this bill provided for the phaseout of the current Business and Occupation Tax, replacing it with a severance tax on natural resources, a business franchise tax and a corporate net income tax.

Although the business climate for forestry is somewhat brighter than the state's business climate as a whole, the magnitude of the deficiencies evident in its supporting infrastructure and business laws still dampen forest-based investments in West Virginia. This conclusion is supported by the fact that major capital investments in forest-based industries suitable for location in West Virginia are already being lost to neighboring states. The forest products industry in West Virginia has the resources to be competitive in both the national and world economies. With planning and some assistance it is capable of providing additional jobs, income, and other economic benefits in the near future.

CONCLUSIONS

This section contains a summary of the overall conclusions reached during the study, grouped by topics. More comprehensive discussions of the author's conclusions may be found in particular volumes of the series.

Forest and timber resources and inventory

West Virginia has an outstanding forest resource base capable of supporting more than twice the present volume of timber utilization and timber-based industrial activity. With an estimated 30.7 billion board feet of sawtimber currently standing in West Virginia's forests, the potential contribution of timberland resource use to the state's economy is considerable. More than 80 percent of the state is covered by forests, and 83 percent of the state's commercial forest land is capable of growing at least 50 cubic feet of wood per acre per year. The positive economic potential of West Virginia's forests is due both to the current timber inventory and the productive capacity of the state's forest land. Much of the timber inventory is in trees just now reaching desirable size and quality. A general examination of the types and levels of utilization of nontimber forest resources in the state indicates that these, too, are being utilized far below capacity. Timber utilization could expand considerably without adversely impacting other forest resources and uses.

West Virginia has substantial volumes of fine hardwoods. These species have wood properties that are desirable for use in veneers, furniture manufacturing, and other high-value wood products. West Virginia plays a significant role in supplying the raw material needs of the fine hardwood market. The state's timber inventory also contains a large component of low quality timber of less-desired species. Developing production capacity and markets for products made from this type of raw material holds promise for more complete utilization of the state's timber resources in the future. This outlook must be tempered with the observation that low quality timber is readily available in most of West Virginia's neighboring and competing states. Some of these are already working hard to attract new industry based on low quality hardwood utilization. The positive characteristics and economic potential associated with West Virginia's forest resources get little national recognition or attention. The state has not been a successful contender for major timber-based capital investments.

Timber harvest

For many years the harvest of timber from West Virginia forests has been less than half of net annual growth. The sawtimber harvest decreased by almost one-third between 1964 and 1979. Low harvest levels have prevented West Virginia from realizing one-half billion dollars annually in potential state and personal income from jobs in the timber harvesting and wood products sectors.

The bulk of the state's timber harvest traditionally comes from the northeastern and southern parts of the state, and these areas contain the infrastructure to expand wood products production in the future. The northwestern region of the state should not be overlooked for future development, since the timber resource base there is also becoming substantial.

Despite the low rate of timber harvest in the state, timber still ranks among the state's largest cash crops. Timber stumpage sales generate $35–$40 million annually for woodland owners. Sawlogs are the state's principal roundwood product. Production of pulpwood, fuelwood, mine timbers, fencing, and veneer logs is also substantial. Sawlogs will almost certainly continue to be the state's main roundwood product, but the relative importance of mine timber production may decline somewhat, with pulpwood and veneer log production becoming relatively more important. In terms of total value, sawlogs are the leading component of the timber harvest, followed by veneer logs and mine timbers. The value of veneer logs harvested may exhibit a relative increase in the future, as may that of pulpwood, particularly if new production facilities which utilize hardwood pulpwood locate in the state or near its borders. Christmas trees are also a valuable cash crop and may be expected to maintain their importance in the foreseeable future.

It is notable that West Virginia is a net exporter of sawlogs, shipping 53.5 million board feet of sawtimber to other states in 1979. The state is also an important exporter of pulpwood, with all of its production going out of the state. West Virginia is a net importer of veneer logs.

Overall, relative prices of hardwood stumpage should not increase substantially until after the year 2000, but stumpage prices for fine hardwoods have already risen significantly and are likely to continue to do so in the next few decades. The prospect is for reasonable growth in future demand for timber from West Virginia's forests, with fairly steady price trends overall, but increasing relative prices for fine hardwood saw and veneer logs.

Primary utilization

Primary wood product manufacture is the largest segment of the state's timber-based industry. West Virginia's primary timber-based industry is small, segmented, and undiversified. It is dominated by logging, sawmilling, and closely related primary manufacturing activities. The state has never had a highly developed secondary wood industry and has exported most of its lumber and veneer to be manufactured into finished products elsewhere. This pattern of manufacturing has kept the state from achieving greater wood industry employment and higher product values.

In 1984, the total sawmill production capacity for the state was estimated to be perhaps as high as 600 million board feet per year. Yet, the state's sawmills produced only 384 million board feet of lumber that year,[5] indicating again that the actual utilization of the state's wood products production capacity is far below potential. After many years of fragmentation, there has been a recent modest reconcentration of productive capacity in the state's sawmilling industry. The four largest lumber-producing companies currently account for between 22 and 30 percent of the state's lumber-producing capacity.

West Virginia's wood manufacturing industry is structured primarily to use large, high quality hardwoods rather than the relatively abundant, small size, low quality timber which comprises a large part of the state's forest inventory. This bias in the raw material requirements of the state's primary wood-using industry is a problem which must be addressed in any effort to expand and develop the wood products industry.

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[5] The U.S. Department of Commerce, Current Industrial Report revised figure for 1984 West Virginia lumber production is 384 MMBF. The preliminary figure reported in Volume 4 was 285 MMBF.

West Virginia exports large volumes of unprocessed sawlogs, pulpwood, and raw lumber to other states. In effect, it has become the woodbasket for wood-based industries in neighboring states. Long experience has shown that regions that mainly extract and export primary resources do not share in the economic growth which comes from the manufacture and marketing of final products. One of the keys to full development of West Virginia's wood products industry will be breaking it out of the pattern of operating mainly in extraction and primary processing.

Secondary utilization

Secondary wood manufacturing activity in the state is not as diversified nor as extensive as it should be, considering the availability of raw materials, the size of the state's primary wood industry, and proximity to major metropolitan markets. The full economic value of the state's timber resource is not being realized because the wood products industry lacks diversity and vertical integration.

The majority of the state's secondary wood products manufacturers are small, employ relatively few workers (38 percent employ less than ten people), and serve limited markets. There are only 20 firms manufacturing secondary paper products in West Virginia, yet paper products is the largest and most valuable segment of the state's secondary wood products industry. It accounts for 50 percent of the workers and 55 percent of all payrolls in the state's secondary wood products industry.

The low level of kiln drying of lumber in West Virginia is a major constraint on the development of medium-sized secondary processing plants and is an indication of the weakness of the state's secondary wood manufacturing industry. Development of a larger and more stable kiln drying industry would be an important step toward increasing secondary wood products manufacture in the state.

Secondary manufacturing is the weak link in the state's wood-based industry. By failing to manufacture more finished wood products, West Virginia is forfeiting added product value, jobs, personal income, and tax revenue. A larger, more diversified secondary wood-using industry would stimulate primary wood processing activity by offering an in-state market with advantages such as lower transportation costs and faster deliveries.

Economic impacts of timber-based industry on the state economy

The full value of the state's timber resource, as well as potential employment opportunities, are not being realized due to the present size and structure of West Virginia's wood products industry. Despite its resource advantage, the timber-based industry accounts for less than 1 percent of the gross state product. Employment in the wood products industry represented less than 1 percent of the state's total working labor force and provided less than 0.5 percent of West Virginians' personal income in 1982. The wood product industry's direct contribution to the state through business tax revenue is very small—an estimated $4.3 million annually.

Wood product industries assume a much greater importance in some counties and are sometimes the main source of employment in heavily forested rural localities. In these same areas, property taxes from forest land are a substantial portion of local tax revenue, although it is impossible at present to make a reliable estimate of these revenues.

The wood products industry has considerable secondary effect on the economy of the state and has even greater potential. Wood industry economic multipliers—which estimate industry impacts on the state economy—approach those of the state's leading industries, and generally are higher than the all manufacturing average. A more balanced development of the wood-using industry would likely increase these multiplier effects.

Although a substantial volume of products such as sawlogs, pulpwood, lumber, treated wood products, cabinets, and pallets are shipped out of the state, the wood products industry accounts for only 1 percent of the value of all state exports. The lack of vertical integration and the failure to process more finished wood products has greatly limited the amount of value added generated by the state's wood industry.

West Virginia's timber industries experienced substantial declines in number of establishments, employment, value added, and capital expenditures during the period 1972–1982. This has seriously weakened the ability of the industry to expand in response to an improving resource situation and the prospect of new and larger wood products markets in the future.

West Virginia's wood product markets and the marketing situation

Half of the nation's population lives within a 500-mile radius of West Virginia. The state is well located in terms of access to major wood markets and accessibility for on-site forest uses, such as recreation. But West Virginia has lost opportunities to expand its wood product sales to existing markets, to develop new markets, and to attract new wood product enterprises because of a lack of attention to marketing. Efforts to market both West Virginia wood products and to promote the state as a location to manufacture wood products have been insufficient.

With its low population and small industrial base, West Virginia does not represent a large market for final wood products. The state's present and future role is as a supplier of hardwood products to other market areas, both domestic and foreign.

The production of lumber and lumber-based products, the backbone of West Virginia's wood products industry, is highly competitive. West Virginia lumber producers have little market influence. The small size, lack of integration, and undiversified product lines of the typical West Virginia wood manufacturing establishment are major economic disadvantages. Small firms lack the resources to be competitive in product marketing and often cannot acquire the capital to finance needed expansion or diversification. The state's heavy reliance on timber extraction and primary processing and the lack of extended primary and associated secondary manufacturing have further weakened the state's marketing position relative to timber-based industries in neighboring and competing states.

Although private wood industry firms have promoted their individual product lines, there is no organized industry-wide marketing effort of any kind in West Virginia. Neither has any state agency done anything effective in the areas of researching wood product markets or promoting West Virginia wood products as a class.

The narrowly focused marketing strategy of West Virginia wood products firms, in general, is illustrated by the following statistics. About 50 percent of West Virginia's lumber production goes to the North Carolina furniture manufacturing market, while other potential lumber markets are not cultivated. Only about 15 percent of the value of all West Virginia wood products are finding their way into the growing and potentially highly profitable foreign export market.

The authors believe the substantial decline in West Virginia's wood products industry during the 1970's was due, in part, to the lack of a strong marketing program designed to promote the state's wood products. Since secondary wood industries tend to put more emphasis on marketing than do primary industries, the lack of a strong secondary industry in the state accentuated this decline.

Four factors hinder the development of a stronger secondary wood products industry in West Virginia: difficulty in obtaining the needed capital at reasonable interest rates; a shortage of experienced woodworkers with the necessary skills; an inadequate supply of kiln dried lumber; and lack of marketing information and an almost non-existent marketing campaign. All these problems must be addressed to develop the state's secondary industry. Perhaps the most critical is the marketing problem. The modern wood products economy is market driven rather than production driven, so that sophisticated marketing is essential to the consistent success of a modern wood products enterprise. A West Virginia wood products marketing program is essential to the future growth and vitality of the wood products industry in the state.

Future market prospects and development potential

Despite the weaknesses and problems associated with the present size and structure of West Virginia's wood industry, projections of future domestic and worldwide demand for wood products are encouraging. They promise substantial opportunities for timber-based economic growth in West Virginia. Dependable, growing markets for wood products may be the most important factor affecting future growth of wood products enterprises in West Virginia.

The state's wood industry cannot expect to grow and prosper if its future development is confined to traditional production activities. Production of grade lumber and veneer from West Virginia's fine hardwood timber will probably continue to be the backbone of the state's wood industry for some time, but the real chances for substantial long-term growth in the state's wood industry lie in other areas.

New employment opportunities, larger incomes to woodland owners, growth in the state's economy, and long run improvement in the quality and utility of the timber resource are possible. To achieve these benefits, West Virginia must attract enterprises with production technologies for large-scale utilization of small size, low quality hardwood timber. The rapidly growing structural panels and fiberboard industries hold perhaps the greatest potential. New products from these industries include waferboard, oriented strandboard, and medium density fiberboard. Also, new papermaking technologies, such as press drying, which utilize a high percentage of hardwoods in the pulp mix, may offer new opportunities for West Virginia to attract primary paper manufacturing facilities.

In the area of secondary wood products manufacture, the state would be well advised to explore custom furniture and cabinet enterprises and other hardwood architectural and specialty products, dimension parts and standard-sized blanks, and secondary paper processing and secondary manufacture of products made from structural composite panels and fiberboard. The secondary paper industry has excellent growth prospects because the state is close to both raw paper sources and final markets, and because the industry adds so much value to the product. Secondary manufacturing from composites will flourish if primary producers of these materials can be established in or near the state.

Institutional factors and limitations

West Virginia has had to contend with a reputation, be it real or imagined, of having a relatively unattractive business climate. Although the state's wood industry is unique, it is influenced by and subject to the overall economic climate of West Virginia and of the national and international wood products industry. Both local and far-ranging economic and business climate factors influence the state's wood-using industry.

Generally speaking, West Virginia's business and economic climate has not encouraged the systematic expansion and location of wood products enterprises in the state in recent years. Difficulty in obtaining in-state financing to support entrepreneurial activity has been cited frequently as a major obstacle confronting the startup of new wood enterprises. The extremely complicated state business tax structure has frustrated businessmen both inside and outside the state.

The transportation system in West Virginia also hampers wood industry development. Due to the mountainous terrain and the poor condition of many of the state's roads and bridges, wood product firms often suffer a cost disadvantage when harvesting and moving timber and wood products around the state. The incomplete development of West Virginia's interstate highway and related arterial system has also helped suppress the establishment of secondary wood manufacturing facilities in West Virginia.

Although the state's labor force has been generally perceived as being a problem by many out-of-state concerns, it has been established that the state's wood products labor force is not characterized by the high percentage of union membership, relatively high wages, and instability problems found in some of the state's other industries.

In summary, the authors feel that the deficiencies in West Virginia's physical infrastructure and business laws will require significant institutional and community attention and a long term commitment toward improvement if West Virginia is to realize substantial growth and expansion in its industrial base and wood products industry. After a half century of the "Appalachian" image, this commitment cannot appear as just an attempt to gain parity with other states. The attainment of real progress will necessitate that the state include in its economic development programs some bold and pioneering initiatives that show a determined and progressive commitment toward a stronger and more vital business environment.

RECOMMENDATIONS

In the course of this research the authors have gained many insights into the structure and workings of West Virginia's timber-based economy and its place in the state's general economy. The facts found and verified and the conclusions reached lead to a number of recommendations; these range from the very broad—e.g., concerning economic development strategy for the state—to those which are very specific to some portions of the timber-based economy. The recommendations are grouped by general subject areas. They are presented without elaboration, since the authors feel that their justification is found in facts revealed and conclusions reached throughout the project.

Forest Resource Data and Utilization Information

1. Begin planning now for the 1987–1988 forest survey of West Virginia by the U.S. Forest Service. Plan to have the entire survey computerized, programmed for quick retrieval, and available to state agencies and personnel for use in research and monitoring activities and in handling information requests. Also desperately needed are mid-cycle or quarter-cycle timber resource surveys so that in the future the state will not have to rely on 10–15 year old resource data. The West Virginia Department of Agriculture's Division of Forestry (State Forestry Division) should cooperate with the U.S. Forest Service to rapidly compile and distribute survey results; this should include cost-sharing for data compilation and analysis, if that will expedite release of survey results.
2. The West Virginia Department of Agriculture's Crop Reporting Service should initiate a quarterly timber sale and harvest reporting program so that timber production, inventory, and prices can be accurately monitored.
3. The Governor's Office of Community and Industrial Development (GOCID) and the State Forestry Division should cooperate to create a forest resource and industrial needs data bank to assist in economic development efforts. The data bank must be capable of quickly and accurately matching wood resource needs and plant specifications to suitable locations in West Virginia.
4. The West Virginia Forestry Association, the State Forestry Division, and West Virginia University's Cooperative Extension Service (Extension Service) should more actively promote and support the Tree Farm Program in West Virginia as a means of making private forest landowners more knowledgeable about the management and production of forest resources.
5. The State Forestry Division should reestablish adequate statewide staffing and coverage of the service forester and fire protection programs in order to ensure that new programs and services are not hampered by a shortage of personnel.
6. The State Forestry Division, in cooperation with the U.S. Forest Service, and West Virginia University's Division of Forestry (WVU Division of Forestry) should conduct a survey of timber industries, products manufactured, and production levels every three years so that resource managers, businesspeople, and economic development planners can have up-to-date data and assessments of activity in the wood products industry.

Research and Technology Transfer

1. The state should promote hardwood utilization research by forming a research center at the WVU Division of Forestry. The Legislature should

authorize basic funding for the center and supplementary funds should be solicited so that the center's research capability would attract industry attention nationwide.

2. The West Virginia Forestry Association and State Forestry Division should support information dissemination activities aimed at nonindustrial private forest landowners and highlight federal, state, and private landowner assistance programs.
3. WVU's Cooperative Extension Service should hire foresters as extension agents in counties that are heavily forested.
4. The Legislature should authorize and fund increased salaries and personnel in the State Forestry Division and the Extension Service, especially for county foresters and forestry specialists.
5. State government should support publication and dissemination of research which increases the general awareness of forestry and its economic potential in West Virginia, especially research which has practical applications in forest industries in West Virginia.
6. The GOCID and the Center for Economic Statistics at West Virginia University should publish economic data or analyses which will dispel unsound criticism or highlight the strengths of the state's basic social and economic infrastructure in order to cast a more positive light on its business climate.
7. State government should support research and marketing efforts aimed at increasing the usage of underutilized hardwood species such as yellow poplar and red maple and small-size, low quality timber of all species.
8. The State Forestry Division's utilization specialists and West Virginia University's forest industry extension specialists should be strongly supported and encouraged to conduct programs to inform and assist West Virginia mill owners in the use of equipment and methods needed to manufacture grade lumber and higher valued intermediate and finished products.
9. The State Forestry Division should enlarge and update the timber sales program on state managed forest land. Emphasis should be placed on educating the public on forest management and timber harvesting practices and on modeling efficient timber management and harvesting practices for private landowners and loggers.

Economic Development (general)

1. The GOCID should develop a strategic plan designed to guide the state through the process of upgrading its economic infrastructure and coordinating the redevelopment of its economic base.

2. State planners must seek out and develop those industries which have the greatest potential to diversify, accelerate, and sustain economic growth and which are capable of being competitive in both the national and world economies.
3. Priority for state financial assistance should be given to those projects which will stimulate additional value added in primary industries, and which will encourage additional secondary economic activity and offer long-term benefits.

Economic Development of the Timber Industry

1. State government, forest industries, and individual private forest landowners should develop a cooperative program to provide a favorable business climate aimed at supporting a multi-dimensioned forest economy.
2. Economic development efforts should strive to correct the undiversified structure of the state's wood industry and to provide more investment and operating capital for wood product enterprises.
3. State development programs should actively encourage new and established forest businesses to operate and expand in the state.
4. The GOCID and State Forestry Division should immediately and aggressively pursue the goal of having composite board manufacturing facilities locate in the state. These products hold the greatest potential for large-scale development and expansion in West Virginia's forest industry.
5. In forest industry development efforts, heavy emphasis should be placed on developing a healthy secondary wood products industry in the state. Priority should be on promoting both secondary industries which utilize primary products (notably hardwood lumber) and those which might be based on promising new technologies in the primary industries (composite wood products and hardwood paper products).
6. State officials should encourage expansion of the secondary paper products segment of the state's wood industry.
7. State government should initiate managerial and financial support programs to maintain and enhance a strong lumber industry. These programs should be designed to encourage capital investments for mill modernization, horizontal integration, expanded services such as planing, custom sawing and machining, expansion of kiln drying capacity, diversifying product lines, and fostering better marketing practices.
8. The State Forestry Division and WVU Division of Forestry should encourage expansion of kiln drying capacity in the state and provide training and technological expertise in hardwood drying techniques.

9. The State Forestry Division, WVU Division of Forestry, Extension Service, GOCID, and the West Virginia Forestry Association should initiate a statewide forest products marketing program which "sells" West Virginia wood products, the forestry image of West Virginia, and opportunities for development.
10. State government should provide startup assistance to new timber and wood manufacturing industries and provide on-going managerial and marketing assistance on a consulting basis to both established and new wood processing enterprises.
11. Any state monies targeted for investments in the wood products industry should be allocated so that priority is given to secondary wood product industries or to wood businesses where such an investment would result in an increase in value added per unit of production, increased exports activity, and/or diversification of the state's timber-based industry. Awards which will not result in product diversity or horizontal/vertical integration should be reviewed very carefully.
12. In order to be more attractive to new enterprises which may be considering business locations in West Virginia, the state should seek to gain a concentration of trained wood industry workers in strategic areas of the state by providing vocational training and mobility incentives to workers.
13. State government should initiate and fund a determined and long-term effort to improve state roads and bridges to standards capable of handling weight requirements of logging trucks.
14. The State Tax Department should restructure the pending timber severance tax so that it is not based on B&O Tax law; enact a severance tax which is similar to and more in line with rates in neighboring and competing states; improve the severence tax collection and reporting procedures; consider levying an additional tax on unprocessed timber products exported from West Virginia; designate at least a portion of timber and wood industry tax receipts to programs for forest management and industry development.
15. Several new specialist positions should be established either within the Governor's Office of Community and Industrial Development or the State Forestry Division to handle forest-based economic development initiatives, to assist and facilitate the marketing of forest products from West Virginia, including exports, and to coordinate on-going managerial and marketing assistance programs.
16. State government should officially designate the forest industry as a "priority industry" for economic development. Included with this designation should be the establishment of a special development corporation similar to the West Virginia Automobile Assistance Corporation and other

"special status" provisions.

17. The real growth potential of the state's timber industry lies through a coordinated effort aimed at producing higher valued products from the state's timber resources and manufacturing activities, researching, developing and implementing an effective marketing program for the state's wood products, diversifying the state's timber-based economy and aggressively pursuing wood product manufacturing facilities which are suitable for location in West Virginia. These points should be used as criteria in judging the merit of economic development policies and programs for West Virginia's timber-based industry.

COMMENTS

West Virginia needs to develop the potential of its forest resources and forest-based industry. The state is particularly vulnerable to extreme economic cycles, partly because its economic base is narrow and undiversified. One promising development strategy for the state, then, is to seek every reasonable opportunity to broaden its economic base. To accomplish this, policymakers and business leaders must develop those industries with the potential to contribute to the state's economic growth and which are capable of being competitive in both the national and world markets.

West Virginia has just this type of potential in its timber-based industry. Few states can boast of having a more abundant and better quality hardwood resource, and, despite its structural inbalance and current limited economic contribution to the state, the timber-based industry in West Virginia is ripe for development. This development potential exists because of the combination of the state's advantageous resource position and low levels of utilization, projected growth in national and world wood product markets, and the underdeveloped, undiversified nature of the industry in West Virginia.

The key to economic growth and development in West Virginia's wood products industry is the same as that for the state as a whole: *diversification*. The state needs to diversify its economy to reduce reliance on its traditionally dominant industries. The timber industry needs to diversify beyond the presently dominant activities of timber harvesting and primary lumber manufacture. Many of the recommendations in this report were made with this in mind.

West Virginia's economic future is dependent on its natural resource base, the productive capabilities of its people, and the ability to attract and hold investments in its economy. These three ingredients can, with careful policymaking and planning, produce a healthy wood products industry in West Virginia—an industry capable of contributing to growth, diversification, and greater stability in the state's economy.

APPENDIX

Definition of Terms

Board foot—A unit of lumber measurement 1 foot long, 1 foot wide, and 1 inch thick, or its equivalent. By forest survey convention, softwoods less than 9 inches and hardwoods less than 11 inches dbh do not contain board foot volume. Abbreviated bd. ft. or b.f.

Commercial forest land—Forest land that is producing or capable of producing crops of industrial wood (more than 20 cubic feet per acre per year) and is not withdrawn from timber utilization. (Industrial wood: all roundwood products except fuelwood.)

Cord—A unit of gross volume measurement for stacked round or split wood. Generally, a standard cord is stacked 4 feet long by 4 feet high and 8 feet wide, for an overall volume measurement of 128 cubic feet, including airspace. Ninety cubic feet of solid wood is also equivalent to a standard cord.

Cubic foot—A unit of solid wood measure 1 foot by 1 foot by 1 foot. Generally applied to measurement of growing stock volume. Abbreviated cu. ft. or c.f.

Dbh (diameter breast high)—The diameter outside bark of a standing tree measured 4.5 feet above the ground.

Forest type—A category of forest defined by its tree cover composition; named in accordance with the individual or collective tree species which make up more than 50 percent of stems in the stand of trees. E. g., the oak-hickory type would be composed of over 50 percent stems of oak and hickory species together.

Gross state product—The current market value of goods and services produced in the state in a given year.

Growing stock volume—Cubic foot volume in live trees of commercial species that are of sawtimber or poletimber size, excluding rough or rotten trees. (Poletimber: live trees of commercial species and merchantable quality that are at least 5 inches dbh but are smaller than sawtimber size.)

Hardwoods—Dicotyledonous trees that are usually broad-leaved and deciduous, including oaks, maples, and hickories.

Log grade—A classification of logs based on external characteristics as indicators of quality and value.

Multiplier—A number, used in input-output analysis, which, when multiplied by current output, estimates the total loss/addition to economic output resulting from a given change in economic activity.

Pulpwood—Roundwood or plant by-products cut, chipped, and prepared for manufacture into wood pulp.

Roundwood—Logs, bolts, and other timber generated from harvesting trees for industrial or consumer uses.

Sawlogs—A log that meets minimum standards of diameter, length, and defect, including logs at least 8 feet long, and with a minimum diameter inside bark of 6 inches for softwoods and 8 inches for hardwoods.

Sawtimber volume—Board foot volume in live trees of commercial species, that are a minimum 9 inches in dbh for softwoods and 11 inches dbh for hardwoods and contain at least one 12-foot or two noncontiguous 8-foot merchantable sawlogs.

Softwoods—Coniferous trees that are usually evergreen, having needles or scalelike leaves, including spruce, pines, and hemlocks.

Timber harvest—Total production of round timber for conversion into wood products.

Timber removals—The net volume of growing stock trees removed from the inventory by harvesting, cultural operations, timberstand improvement, land clearing, or changes in land use.

Timber stumpage—The value of marketable timber as it stands uncut in the woods; in a general sense, the standing timber itself.

Value added—The conversion of the value of shipments (including resales and miscellaneous receipts) to value of production by adding the ending inventory of finished goods and work in process inventories and subtracting the beginning inventory. The cost of materials (including materials, supplies, fuel, electric energy, cost of resales, and cost of contract work) is then subtracted from this value of production to obtain value added.

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